Notebook, N-88-01-19

This notebook covers the period January-May 1888. It is the first of 14 notebooks used by Arthur E. Kennelly to transcribe material from the rough record books utilized by the experimenters in the Galvanometer Room. The book contains notes, drawings, and tables regarding pyromagnetic induction, Edison-Lalande and pyrocarbon batteries, voltmeters and viscositometers, and other electrical experiments. Inserted into the book is a 10-page memorandum from Edison to Kennelly pertaining to an electromagnetic induction experiment. Among the experimenters whose work appears in this book are F. P. Bergh, Johannes H. Cuntz, Robert T. Lozier, Walter J. McConnell, and Osgood S. Wiley. At the end of the book can be found an index and a list of experiments with their assigned number. The front cover is labeled "Record Book." The spine is labeled "84." The book contains 89 numbered pages. There are also several unnumbered pages, some of which have graphs pasted onto them. At least one page has been removed from the book.

The index has been filmed first.

Missing page numbers: 58-59.

Record of Experiment Numbers.

Date of taking Number	No. taken	Nature of Experiment	Experimenter		Date of completion
27. 1.88	8	Long Electromagnet	Mr McConnell		
- -	9	Pyromag: induction	Mr Wiley		
- -	10	~~Viscositometer~~	Mr Lozier		
- -	11	Pendulum E.M. Ind:	Messrs Kuntz & Berg		
31. 1.88	35	Mag: bridge	Mr Kennelly.		
8. 2.88	59	Radiation from coils	Mr Lozier		
8 - 2.88	60	Pyro. cell (carbon)	" "		
9 - 2.88	25	Pyro. induction nickel strip generator	Mr Wiley		
18. 2.88	101	Coating copper with Nonconductor.	Mr Wiley.		
16. 3.88	129	Lalande battery			
29. 3.88	27	Transformer	Mr Kennelly.		
18. 4.88	24	Motograph			
18. 4.88	151	Permeability of iron			
5.5.88	164	Res: of plates			
15.5.88	168	Flying motor			
26.5.88	174	Res. of glass			
	178	Zinc plates			
	28	Secondary cell			
	40	Dynamo [illegible]			
	183	Light			
	145	Transformer			

Ayrton & Perry - 15
Ballistic Constants - 72.77.79.81
Brown Engine - 86
Clock - 41.43
Elliott Standard - 8.52.
" Bros - 12
Chem Meter - 35.39.43.
Electrometer wall - 52.
Galvo tests - 52-53.
Jamen magnet - 2.4.5
Long magnet - 3.5.6.7.8.10.12.20.21.22.25.26.27.28.30.31.33.38.46.
Lalande cells - 18.19.21.22.23.24.25.26.27.28.29.30.31.32.33.35.
36.38.39.41.42.43.44.45.46.47.48.49.50.51.52.53.60.86.
61.62.63.64.65.67.68.69.70.72.73.77.78.79.81.82.83.84
Meter - 86.88.89.91.93.94
Magnetic bridge - 5-10
Nickel Plating - 5-6.
Observation magnet - 86.87.
Paraffine & Mercury - 1
Pendulum induction - 5.7.8.9.10.11.12.13.14.15.16.17.18.41.66.67.70.71.
72.76.78.80.81.83.84.86.87.89.90.91.
Pyro-Magnetic - 20.21.23.25.26.28.30.31.32.34.35.37.38.39.40.42
43.45.47.51.53.54.55.56.57.65.69.74.
Phonograph - 30.33.
Queen & Co - 17.
Radiation - 80.82.88.89.90.91.
Res of shack - 8.
" in telephone - 2
Standardising bridge - 74
Storage cell - 65.68.71.
Solenoid - 56
Siemens - 35.36.37.38.68
Scribbles bridge - 1-79.
Sawing wood - 2
Transformer - 73.79.82.
Voltmeter Compared - 3.46.
Viscositometer - 5.6.8.11.12.
Waltham Watch - 8.10
Waldo - 49.

XE-172 N-88-01-19

Record Book.

Galvanometer Room

Edison Laboratory,

Commenced 19th January 1888.

19th January 1888

A small disk of copper had its surface oxydized by heating over a bunsen burner and then imbedded in paraffine wax exposing on its upper surface about one square centimetre. On this surface mercury was poured to the depth of about 3/8".

Res: of film measured by bridge

3 Fuller cells	at first	2.1ω
	after 3 mins	2.6ω
	" 6 "	2.1ω
	" 15 "	0.2ω

so that in a quarter of an hour the mercury found its way through the film. The res: of leading wire 0.1ω.

Comparison of Mr Seibel's sliding wire bridge with ours of Trans. R.S.

100 ω coil	—	100.4	− .095 =	100.3ω
10 ω "	—	∞		
1 ω "	—	1.105	− .095 =	1.01 ω
Superst. 10 ω "	—	10.14	− .095 =	10.13 ω

Infinity break in 10ω coil.

19.1.88

Res: of Bi_2S_3 in telephone box between platinum surfaces.

The sulphide was powdered and a layer of about 1/16" placed in box.

Res: with no weight but lid of box	6.5ω
10 grammes added	1.5ω
20 - -	1.0ω
~~20~~ - -	

The sulphide was then taken out powdered more finely and heated to drive off moisture.

No extra weight	nearly ∞
10 grms added	9ω
0 weight	15,000ω
10 -	140ω
0 -	300,000ω
10 -	160ω
20 -	133ω.
0 -	123ω.

Tried sealing wood with a fine wire of platinum-iridium. Succeeded fairly. Current abt 6 amps.
Wire soon broke.
Tried a silver wire but could not heat it sufficiently with 10 amps.

20th January 1888.

Tried following experiment.

A large Jamin magnet was supported in a vertical position and on its poles were placed vertically two coils of enamelated wire on iron cores. The res: of the two coils in series was abt 120ω. Wires were led from these coils to a sensitive astatic Thomson Galvanometer. A slip of asbestos paper was laid on the upper surface of the ~~spools~~ to protect the rubber and then a slip of thin sheet nickel laid across the pole faces AB. 1½" × ⅛" × .006". The sudden raising of this nickel plate on or off the poles gave a distinct throw of the galv. spot (90 div)

While the strip rested across AB, the flame from a Bunsen burner close by was projected by a blowpipe suddenly on to it. A very slight movement of the spot one or two divs in the direction indicating lessening magnetic current through AB was repeatedly observed. The same effect was noticed when an iron wire bundle of 3 or 4 flat turns was placed across AB and the blowpipe flame ~~was~~ projected on it. When an iron nail was placed in the same position however no movement of the spot could under the same conditions be discerned, the inference being that the heating of the larger mass took place more slowly. To raise the nickel strip to red heat it was estimated 3 seconds were required, with the bundle of iron wire less and the nail much longer.

Five voltmeters were compared as follows, on the electric light mains.

H+B. no 1. 80 volt	96	
H.+B. no 2. 120 volt	97.7	
H+B Portable	97.8	Mean 98.6
H+B Ayrton & Perry	97.9	
Cardew	102.5	
Edison Hospital	99.8	

Saturday 21st January

The following experiment was made.

An iron wire (telegraph iron wire) 0.225" diam (0.572 cm) and 80 feet (1/0) long) 24.4 metres long was wound with silk covered wire 0.016" diam (.102 cm) the res: of this wire being 17.6 ω T. 60°F.

The ends of this iron wire i.e. the poles were brought opposite each other through a wooden frame, and between was suspended by a platinum iridium wire 0.01" diam (.0025 cm) and 9.25" = 23.5 cm long; a soft iron cylinder needle whose axis lay approximately in the interpolar axis. The length of the needle was 6" (15.24 cm) and at right angles was fixed an aluminium pointer over a graduated dial the length of the pointer being 6.25" = (16.88 cm) The poles of the long magnet were fixed at a distance of about " from the needle.

The period of a complete double vibration of the needle was carefully observed and found to be 1.217 secs; (2416.5 in 300 secs) when the poles were withdrawn and clear of the apparatus.

The current from the dynamo electric lighting was sent direct through the coil at 13.32 cc. the measured strength being 5.49 amps and it was kept flowing for six mins at the end of which time the wire on the magnet was hot and the current had fallen to 5.64 amperes.

The period of vibration in small arcs (not exceeding 10°) during this period of magnetization was observed to be 0.391 seconds. (153.5 per min)

4) The direction of the current was such as to make the ~~south~~ northernmost pole north. The interpolar axis lay approximately in the magnetic meridian.

The magnetising current was taken off at 13.38^m and at $\frac{13.42}{13.44\frac{1}{2}}$ Readings were taken, the mean time of one complete vibration being 0.571 sec (5 in 300 secs)
This was supposed to represent the magnetic force of the pole at 13.45 or seven minutes after interrupting the magnetising current.

At $14.\frac{12}{18}$ The period of one c.w.b. was 0.625 secs, (480 in 300 secs) and this was taken as representative of the force at 14.15

At $14.\frac{42}{47}$ The period was 0.6188 at (485.5 in 300 secs) = force at 14.45

At $15.\frac{12}{17}$ The period was 0.616 secs (or 487 in 300 secs) = force at 15.15.

At $16.\frac{12}{17}$ The period was 0.636 secs (or 472 in 300 secs) = force at 16.15

Daily observations

Time	Condition	Time elapsed since magnetisation	No. of complete vibs in 5 mins	Period of 1 vib in secs	Square of P.T.	% Mag. F
13.32	Magnetised	—	767.5	0.391	0.1529	100
.45	Demagnetising	7 mins.	519	0.571	0.3260	21.9
14.15	"	37 "	480	0.625	0.3906	55.7
.45	"	1 hour 7 mins	485.5	0.618	0.3819	51.6
15.15	"	" " 37 "	487	0.616	0.3795	50.3
16.15	"	2 " 37 "	472	0.636	0.4045	55.3

Sunday 22nd January

At 9.20, the periodic time of one complete vibration was 0.662 seconds. (453 in 300 secs) and the % magnetic force remaining. An error was detected in the calculation of % change in the last column of the preceding page.

Instead of taking the magnetic forces as proportional to the square of the periodic needle time inversely, which applies to a magnetic needle on a pivot, or very long fine thread, the following formula was developed

t_0 = time of vib. no m.f.
t_m = " " full m.f.
t_c = " " any "

$$\% \text{ Magnetic force} = \left(\frac{t_m}{\sqrt{t_c^2 - t_0^2}}\right) \times \frac{\sqrt{t_m^2 - t_0^2}}{t_m} \times 100$$

Taking this formula the corrected % are given in pencil above, and the % this morning = 52.1

Monday 23rd January

50 Gravity Daniell set up and put on s.c.

At 8.16 the periodic time was 0.648 secs. (463 in 300 secs) and % mag. force in magnet 53.9

At about 10.30 the table and magnet pole were shifted several feet to make room for another experiment, and the magnet was exposed to a certain amount of disturbance

At noon the periodic time was found to have altered to 1.042 seconds (288 in 300 secs) and the % of change to have become 20.472.

At 16.00 the periodic time was 1.0045 (287 in 300) and % change 20.23.

The experiment tried on the 20th inst. was today repeated with an electro-magnet instead of a permanent magnet. Different coils of wire on soft iron cores were experimented with and

5) one offering about 400w was found to give the best results of any experimented with thus far. A bundle of iron wires laid across the pole furnished with pole-pieces and heated as quickly as possible to redness with a blow-pipe gave swings of 20 divs on galvo used on 20th inst: in direction of lessening mag: current. Nickel and nickel iron in strips were also tried without getting very good results swings of 10 divs on heating and about as much on the opposite side on cooling being observed.

Tuesday 24th January

at 8.35 the periodic time of the needle between the poles of the long magnet was found to be 1·071 seconds (280 in 300') and the % of charge remaining 19·3.

The magnet was then removed and arrangements made for making the experiment afresh.

Prepared the viscosimeter. Suspended the disk and mirror with the aid of two platinum wires each 1 mil = ·0025 cms diam

Prepared the magnetic bridge for experiments. Res. of coil AB 9.40

BC 9.40

CD 9.60

connected all three coils permanently.

Nickel plating on iron was deposited by using clean russian iron 10 gravity cells and solution of Nickel Ammonia Sulphate and Ammonia Sulphate

Wednesday 25th January

Completed the connections of the pendulum Induction apparatus, and obtained preliminary experiments with it.

Res. of coil AB of electromagnet 16.50

" " CD " 2.40

Total res 4.06.0

The res: of the other connections to the galvanometer, exclusive of the fine platinum wire (·005") is about ·7ω.

In 10 complete swings the ballistic galvo: deflection fell from 266.5 + to 93+ and the time of 11 complete swings (vibrations) was 393 seconds.

The long electromagnet was mounted fresh and short pole pieces convex to the radius were placed on it end. The time of vibration in air free from the poles was 1·234 secs. from several set of observations (243 in 5 min). The current from the dynamo was put on at 16.21 for 5½ min in a direction opposite to that in the previous experiment, so as to reverse the magnetism residing in it + to make the left hand pole a north-seeking one. During the period of magnetisation 100 = 5 amperes approximately, the period of vib. was 0.597 seconds (402 in 4 min). at 16.26.20 the current was taken off, the wire on the magnet being warm. at 16.28 the period of vib. was 0.789 seconds (76 in one min).
at 16.36 it was 0.795 seconds (377 in 300 sec)
at 16.55 " " (378 - 300.)

Preliminary experiments were made with the viscosimeter. Thus Black oil received.

6)

Thursday 26th January

Long magnet experiment.

8.15 / 9.33	Periodic time 0.798 secs.		376 in 300 secs.	
8.45 / 8.45	-	0.818	366.5	
9.15 / 9.15	-	0.813	369	
10.10 / 10.15	-	0.842	356	
11.15 / 11.20	-	0.831	361	
12.20 / 12.25	-	0.833	360	
15.40 / 15.45	-	0.831	361	
17.25 / 17.30	-	0.835	359	

Some iron wire was nickel plated on preceding day (25th) using solution ½ lb Nickel Ammonia sulphate 1½ ounces of ammonic sulphate 12 lbs distilled water.

Experiments were continued with the viscosimeter and both bifilar and unifilar suspensions tried

Two binding posts were nickeled for magnet experiment also two were cobalted.

Thursday 26th January

Long magnet loss of charge.

Time of observation after magnet first fired	Number of swings (both ways) in 5 mins	Periodic Time of one complete osc.	% of Mag. left.	
0.0.0		0.847	100	
0.2.		0.789	66.5	
0.10.	377	0.795	65.6	
0.20.	378	0.795	65.6	
16.0	376	0.798	65.2	
16.15	366.5	0.818	62.4	
16.45	369	0.813	63.1	
17.45.	356	0.842	59.2	
18.50	361	0.830	60.7	
21.54	360	0.833	60.3.	
23.14	361	0.831	60.7	
25.04	359	0.835	60.2	
39.44	359	0.838	60.2	
44.39	351	0.854	57.7	
48.19.	352	0.852	57.9	
64.00	355	0.845	58.9	
67.44	356	0.842	59.2	
112.	356	0.842	59.2	
121.	340	0.892	54.1	
136.16	340	0.892	54.1	
141.	336	0.893	52.7	
144.0	338	0.888	53.3	shaken slightly by accident
160	339	0.884	53.7	
184	347			
192	346			

7)

Pendulum Experiment

With the ballistic galvanometer, the period of vibration was 36·2 seconds (10 in 6'2") and λ was 0·05548, the first swing being 463·2 (236·7 + 226·5) and the 21st (79·5 + 75·25) = 154·75 and ρ was 1·056.

No	Time of Reading	Mag. current in Tans. galvr.	Ohms in cct with magnet	Pendulum swing	Dist. between poles of magnet	Deflection of Galvr.	Mean
1	15·4	16·45'	46ω	7°	5 mm	157·5	
2	15·9	16°30'	46ω	7°	5 mm	159	157·7
3	15·12	16°30'	46ω	7°	5 mm	156·5	
4	15·30	16°30'	46ω	7°	10 mm	113	
5	15·33	15°45'	46ω	7°	10	118	113·8
6	15·37	16°0	46ω	7°	10	110·5	
7	15·55	15°30'	46ω	7°	15	95·5	
8	16·17	15°	46ω	7°	15	92	94·5
9	16.20	16°	38ω	7°	15	96	
10	16·35	16°	38ω	7°	20	84·5	
11	16·52	17°30	38ω	7°	20	96·5	85·3
12	17·18	16°	49ω	7°	20	77·5	
13	17·21	16°30	42ω	7°	20	86	

Friday 27th January.

at 8·10/13 the periodic time of the long magnet needle was 0·835" (359 in 5 mins).
at 13·5/10 it was 0·852 secs (351 in 5 mins)
at 16·45/50 - - - 0·852 - (352 - - -)

No pendulum experiments could be tried until late in the afternoon as the dynamo current was off.

The pendulum was found to make 150 complete vibrations in 5 mins or to be in fact a seconds pendulum, and it lost 1° of amplitude (between ± 9° and ± 4°) every 15 secs: It fell from ± 10° to ± 1° in 165 secs = 1° in 15·

Saturday 28th January

Numbered the experiments as follows

Long magnet — no 8
Hypomagnetic induction — no 9.
Bricrcitometer — no 10.
Pendulum — no 11.

Pendulum experiments

Time	Mag. current Reading of Tans. Galvr.	Resistance in cct.	Pendulum Swing	Dist. between poles	Throw of needle.
10·5	16°	46ω	7°	20 cms	87·5
·20	16°	46ω	7°	2·0 cms	87·25
·40	29·15'	20ω	7°	2·0 cms	134
11·0	30·50'	19ω	7°	2·0 cms.	127·5
20	8·00	99	7°	2·0 cms.	42
·30	8·10	86	7	2·0 cms	47
·45	8°·10'	89	7	2·0 cms	48

8)

Calculation of T and λ. 28. 1. 88.

1st swing 253·5 + 240 = 493·5
12th " 71 + 76 = 147

from which $\lambda = 0.048524$

$1 + \frac{\lambda}{2} = 1.02426$

12 complete swings were completed in 410·5 secs:
so that the period of one swing T = 34·2 secs

Received an Elliott Standard ½# from Schenectady in good order but without fly

Res: of Wach bar: galv 222Ω @ 64° Fah

Monday 30th January.

Calculation of T and λ

The 1st swing was 473 (241 + 232)
10th " " 171 (85 + 86)

from which $\lambda = 0.050472$

$1 + \frac{\lambda}{2} = 1.025436$

and 10 swings were completed in 345 secs
= 34·5 secs per vibration.

The vibration period of the long magnet was observed during the day, the results being entered on page 6. The % change remaining is still about 50% four days after charging.

Received on Friday afternoon, 27th January, the works of a Waltham watch, in a simple jewellers case, from Mr Dins for subjecting to test. The following observations were made

Date	Waltham watch time	My own watch time	Difference (Waltham slow)	Daily rate losing on my watch
29th	8.36·0	8.36.45·5	45·5	
	37.0	8.37.45·5	45·5	
29th	9.24·0	9.25.48·5	108·5	63"
30th	9.00	9.2.48	168	59·5"
	9.1.0	9.3.48	168	59·5"

Placed the Waltham watch between the pole extensions of the big running dynamo for 5 mins 9.24/25. Field very powerful.

30th	16.13.0	16.16.4	184	53"
	16.14.0	16.17.4	184	50"
31st	8.38.0	8.41.44		
Feb 1st	8.39.0	8.42.43·5	223·5	53·5
	10.19.0	10.21.44·5	284·5	56·8

Wheatstone's experiment (no 10).

The motor makes 293 revs: to one revs of the cup. The speed of the cup is 10·25 revs per min: and with distilled water 2 cms deflection was observed with a telescope at about 20 feet range.

Current through cup 6 volts through 5,700Ω
then 0·24 on Wach: = 0·225 cms change +
~~0·25~~ 6 volts (3 fullers) through new doubling
current to have 0·48 = 0·35 cms:
speed 9.90 revs: per min:
Def: 3.015 cms 52 volts thro 2,300Ω = then 5·5

9) Pendulum experiments no 11.

Time	Magnetizing current Volts	Ohms	Reading Tan galv.	Swing of pendulum	Dist. between poles.	Galv. Phase	
		in cor.					21 C
10·50	94	163	4°40′	7°	2cms	24	
11·2	102	163	4°40′	7°	2cms	24	
11·9	100·5	74	8°	7°	"	52	
11·15	107	79	8°	7°	"	48	
11·35	100	84	8°	7°	"	47	
11·39	98	62	12°	"	"	65·5	
11·46	99	61	12°	"	"	66	
11·56	–	∞	0	"	"	0·5	
14·0	95	2000	Stationary 20·45	"	"	3·5	0.05m
14·5	94	1900	21°	"	"	3·5	
14·13	92	930	37°·15′	"	"	6·5	0·10m
·18	93	930	37·40	"	"	6	
·24	93	930	37·15	"	"	5·5	
·30	96·5	440	57°	"	"	10	
·37	96·5	440	57°	"	"	9·5	0.2
·50	97	440	56°·30′	"	"	10·5	
15·0	93·5	250	70°·30′	"	"	15	
·10	96	250	71°	"	"	17·5	
·15	96·5	250	71°·0	"	"	15·5	0·4
·23	93	250	71°·0	"	"	15·5	
·29	95	250	70°·40′	"	"	17	
·45	93	119	7° light	"	"	36·5	
·54	96·5	119	7°	"	"	35	1·0
·58	98	119	7°	"	"	36	

Time	Magnetizing Volts	Ohms	Moment Amperes	Reading Tan galv.	Swing of Pendulum	Distance between poles	Galv Phase
16·18	96	42	2·	15°00′	7°	2cms.	86
·25	96	42	2	15°00′	7°	2cms	84
·40	95	42	2.	15°00′	7°	2cms	84
·56	93	31	3.	21°30′	7°	2cms.	107·5
17·01	97	31	3.	21°00	7°	2cms.	109
·12	104	32	3.	21°30′	7°	2cms.	110

Coefficient $\frac{T}{T+\frac{1}{2}} = \frac{34·5}{1·025444} = 33·6$ log = 1.52493

10)

Tuesday 31st January.

Number of magnetic bridge experiment 35.

Mounted the little magnet about ½ long ⟨ on a platinum wire abt. 10" long) between the bridge poles (¾") apart, and put on a straw about 5" long) as a pointer on a horizontal scale. Obtained an angular movement of about 2° with 4 Fullers on magnet coil ⟨ with no fourth arm.

Pendulum experiment continued as on opposite page. The platinum wire in use with it is about 37cms long). The poles were set 1 cm apart.

The long magnet experiment is nearly complete, the ⟨ at the end of the day being ⟨.

The Waltham watch shews little or no change of rate since having been laid between the poles of the dynamo field magnets.

Time	Magnetising current volts	amps	c.	Reading Tan Galv	Swing of Pendulum	Dist. between poles	Galv Paras
12·00	96	1820	0·05	S. 21°0′	7°	1cm.	6
13·45	97	1911	0·05	S. 21°0′	7°	- -	6·5
14·00	96	1911	0·05	S. 21°0′	"	- -	6·5
·07	97	1911	0·05	S 21°0	-	- -	6
·25	98	970	0·10	S. 37°30′	-	- -	8
·32	98	970	0·1	S. 37°30′	-	- -	9
·43	97	990	0·1	S. 37°30′	-	- -	9
·50	96	410	0·2	S. 57°0′	-	- -	15
15·00	95·5	420	0·2	S. 57°0′	-	- -	15
·30	97	341?	0·2	S. 57°0	-	- -	14·5
·45	97·5	230	0·4	S. 71°0′	-	- -	26·5
·53	97	220	0·4	S 71°30′	-	- -	26·5
·58	98	220	0·4	S 71°30′	-	- -	27
16·12	97·5	116	1·0	L 7°	-	- -	57
·18	98	116	1·0	L 6.30	-	- -	56
·28	97	116	1·0	L 6°45′	-	- -	57
·44	97·5	45	2·0	L 15°	-	- -	122
·54	98	45	2·0	L 15°	-	- -	123·5
·58	98	45	2·0	L 15°	-	- -	123·5
17·08	96	32	3·0	L 21°	-	- -	146·5
·15	94	31	3·0	L 21°	-	- -	147·5
·30	95	31	3·0	L 21°20′	-	- -	147

$$\frac{T}{1+\frac{1}{n}} = \frac{35·45}{1·02866} = 34·55 \quad \frac{\text{for}}{1·838643}$$

11)

Wednesday 1st February

Experiments were continued with insulators in the viscosimeter. No marked results obtained.

The following apparatus arrived from Edelmann Munich through Queen & Co. Phila.

- 1 Quadrant Electrometer
- 1 Large deadbeat galv
- 1 Von Beckl tuning fork chronograph
- 1 Air pump
- 1 Induction coil (vertical pattern)
- 1 Gravity chronograph
- 2 Reading telescopes

Pendulum experiments.

At 9 o'clock 12 complete swings of the needle occupied 423 sec = 35.25 secs per swing. The first semi vibration + was 480.5 and the 25th was 140.25 ∴ $\lambda = 0.05131$

The second set was as follows 11 complete swings in 386 seconds = 35.09 secs per swing. The first semivibration + was 500 and the 24th was 153.5 whence $\lambda = 0.05134$ $1+\frac{\lambda}{2} = 1.02567$

Time	Magnetizing current Volts	Ohms	Sensitivgal.	Amperes	Pendulum swing	Polar surface effect	Throw of needle
13.42	97	-?	21°	0.05	7°	3	2.5
·37	99	1940	21°	0.05	-	-	4.25
14.32	101	1950	21°	-	-	-	2.5
·38	100	1950	21°	-	-	-	4.25
·45	100	1950	21°	-	-	-	3
15.00	104	970	37°30′	0.10	-	-	9?
·08	102	911	37°30′	-	-	-	6.5
·25	100	911	37°50′	-	-	-	4
·53	105	911	37°30′	-	-	-	5
16.6	106	1001	37°30′	-	-	-	5
·13	103	440	57°0′	0.20	-	-	7
·25	105	490	56°0′	-	-	-	8.5
·35	97	423	55°0′	-	-	-	8
·45	102	400	57°5′	-	-	-	7.75
17.9	101	?	72°	0.40	-	-	11
·15	100.5	?	72°	[illegible]	-	-	15
·18	96.5		72°	"	-	-	16
·34	95	116	67°	1.0	-	-	21
·40	97	116	-	"	-	-	19.75
·49	97	61	15°	2.0	-	-	62
·55	98	61	15°	-	-	-	62
18.3	95	36	21°	3.0	-	-	86.25
·7	100	36	21°	-	-	-	86.75
	Coefficient		$\frac{35.17}{1.02566}$	34.29	log 1.535515		

12)

Thursday 2nd February

Wurd Elliott Bros. London send legal ohm standard & legal Micro. by express.

Viscosimeter experiments continued with no very marked results

Long magnet appears to be regaining rather than losing charge, at the end of the day it still about 55 %.

Two sets were taken to determine λ

1st The needle completed 11 vibs in 381 secs = 34.64 per it
The 1st elongation (direct) was 481
" 23rd " " " 162.75
} $\lambda = 0.0492257$, $1+\frac{\lambda}{2} = 1.024628$

2nd The needle completed 12 vibs in 413 secs = 34.42 per vib
The 1st elongation (direct) was 509
" 23rd " " " 158.5
} $\lambda = 0.0484449$, $1+\frac{\lambda}{2} = 1.024224$

The accepted value of T was 34.53.
" " " $1+\frac{\lambda}{2}$ 1.024628

log: 34.53 = 1.538920
$1+\frac{\lambda}{2}$ = 0.010255
1.52765

Time	Magnetizing current Volts	Ohms	Amps	Pendulum swing	Interpolar distance	Ballistic galv. throw	
3.25	101	2052	S. 21°00	7°	3 cms	4	0.1
.32	102	2052	S. 21°00	7°	"	3.5	"
.42	101	2052	S. 21°00	7°	"	4	"
.50	102	1252	S. 37°45	"	"	4.75	0.1
.55	102	1252	S. 37°30	"	"	4.7	"
.59	101	1252	S. 38°0	"	"	5.25	"
4.8	102	500	S. 57°	"	"	8.25	0.2
11	101	500	S. 55°45	"	"	8.5	0.2
19	102	?	S. 57°	"	"	8.5	"
.32	102	260	S. 72°	"	"	13.5	0.4
.38	101.5	240	S. 72°	"	"	14.75	"
.59	101	240	S. 72°	"	"	14.5	"
5.15	99	120	L. 7°	"	"	26	1.0
.22	100	115	"	"	"	30	"
.30	101	85	" .?	"	"	37?*	"
.41	100.5	105	" .?	"	"	32?*	"
.54	100	122	"	"	"	27.25	"
6.02	101	57	L. 14°30'	"	"	58.25	2.0
.9	100	55	" 15°	"	"	57.5	"
.14	100	55	" 15°	"	"	58	"
.30	100	37	" 21°30'	"	"	81.25	3.0
.40	101	43	" 20°	"	"	74*	"
.46	100	39	" 22°	"	"	81	"
		$\frac{T}{1+\frac{\lambda}{2}}$ =	33.70	log =	1.52765		

13) ⅔

Friday 3rd February

Determination of T and λ

1st set T = 34·8 λ = 0·04918 $1+\frac{\lambda}{2}$ = 1·02459

2nd . T = 34·775 λ = 0·0503 $1+\frac{\lambda}{2}$ = 1·02515

Mean $\frac{34\cdot788}{1\cdot02487}$ = 33·943 Log = 1·530775

1 l. s. e. at T 70° F = 21°C changing 0·5 f.

0·7235 mine contents { Disch. 100, 99·5, 100, 99·75 } Mean 100·06 divs.

∴ a throw of n divs: at a constant $\frac{T}{1+\frac{\lambda}{2}}$ of C will represent

$$\frac{n\,C \times 0\cdot7235}{33\cdot943 \times 100\cdot06} = 0\cdot00021302\ Cn \text{ microcoulomb}$$

$$= 2\cdot1302\ Cn\ 10^{-4}$$

$$\log = \bar{4}\cdot3283\,43$$

Calculation of past observations in microcoulomb:

Mag: C. on surface	1 cms interpolar space: Mean throw	$\times\frac{T}{1+\frac{\lambda}{2}}$	2 cms interpolar space: Mean throw	$\times\frac{T}{1+\frac{\lambda}{2}}\times C$	3 cms interpolar space: Mean throw	$\times\frac{T}{1+\frac{\lambda}{2}}$ and	4 cms interpolar space: Mean throw	Same $\times\frac{T}{1+\frac{\lambda}{2}}$
0·05	6·25	0·066	3·5	0·025	3·8	0·027	2·8	0·020
·10	8·67	0·064	6·0	0·043	4·9	0·035	3·09	0·022
·20	14·8	0·109	10·0	0·072	8·4	0·060	7·17	0·052
·40	26·7	0·196	16·1	0·115	14·25	0·102	11·17	0·081
1·00	56·7	0·417	35·5	0·255	27·75	0·203	29	0·210
1·20							45·41	0·351
2·00	123	0·905	84·7	0·607	55	0·417	64·61	0·464
2·50							77·58	0·561
3·00	147	1·082	108·8	0·781	81	0·583	85·41	0·617
4·00							96·08	0·695
5·00							120·24	0·869
	31·1·88	34·788	30·1·88	33·646	2·2·88	33·70	33·943	3·2·88
	p. 10	1·53943	p. 9.	1·52643	p. 12	1·52715	1·530775	p. 13.

Daily Pendulum Observations

Time	Magnetising Current: Volts	Ohms	Sumens Tan Galv	Range Tan Galv	Tangent Galv	Swing of Pendulum	Interpolar distance cms	Throw of ballistic G.	Magnet Current surface
10·47	102	2210	21°			7°	4	2·5	0·05
·57	105	2210	21°			"	"	3·0	"
11·7	104	2210	21°			"	"	3·0	"
·14	104	2210	21°			"	"	2·75	"
·29	105	1090	37°30'			"	"	2·75	0·10
·40	102	32+145	37°30'			"	"	3·25	"
·52	97	32+105	37°30'			"	"	3·75	"
12·02	104	32 145	37°30'			"	"	3·5	"
14·46	96·5	440	57°			"	"	7	0·2
·52	96	410	57°			"	"	7·25	"
·59	96	410	57°			"	"	7·25	"
15·08	97	278	72°			"	"	11	0·4
·15	98	270	72°			"	"	11	"
·21	98	290	72°			"	"	11·5	"
·30	97	95	—	8°		"	"	29	1·0
·39	97	95		8°		"	"	29	1·0
·43	97	95		8°		"	"	29	1·0
·52	96	53		12°		"	"	50	1·5
·58	94	53		12°		"	"	48·25	1·5
16·14	96	53		12°		"	"	48·5	1·5
·14	97	41		16°		"	"	64	2·0
·22	98	41		16°		"	"	63·5	2·0
·32	98	43		16°		"	"	65	2·0
·42	99	100+0·4		19°35'		"	"	79	2·5
·47	98	"		19°35'		"	"	76·75	"
·53	97	—		19°35'		"	"	77	"
17·00	99	20+0·4		32°30'		"	"	87	3·0
·05	98	- - -		22°30'		"	"	85·25	"
·10	96	- - -		22°30'		"	"	84	"
·21	97	100+0·4		25°30'	20°	"	"	96·75	4·0
·27	97	—		24°30'	"	"	"	96·5	"
·31	97	—		24°30'		"	"	95	"
·38	96	25+0·4		23°	30°	"	"	105	5·0
·44	97	-		"		"	"	105	
·48	97	-		"		"	"	103·5	
·58	97	-		"		"	"	104	

Saturday 4th February.

Time	Volts	Magnetising Current Phase	Freq.	Tan. G.	E.D.G.	Parallel Series	Intensity Diel.	Mean	Current
10.25	97	206.5	21°			7°	5	4	0.05
·33	97	-	-					2	-
·37	97	-	-					2.56 2	-
·42	97	-	-					2.25	-
·59	97	1000	37.30			-	-	2.25	0.1
·56	97	-	37°					2.75	-
11·0	98	980	37°					3	-
·6	95	990	37.30					3	-
·13	97	460	58°					4.75	0.2
·19	95	400	57°					5.75 5.62	-
·25	94.5	400	58°					6	-
·34	97	400	57°					6	-
·42	98	240	72°					10	0.4
·45	98	240	-					10.17 10.5	-
·55	99.5	235	-					10.0	-
13.55	95	90		8°				26.5	1.0
·58	94.5	-		-				26	-
14·8	96	-		-				26.25	-
·13	90	71		11°				34.75	1.5
·22	97	57		11.30'				37.81 41.75	-
·29	97	65		12°				38.5	-
·36	97	65		12°				36.25	-
·47	97	50		15.30				47.25	2.0
·53	97	44		16°				50.5 52	-
·58	96	44		17°				51	-
15·05	96	50		16°				61	2.5
·08	96	40		19.30				61	-
·13	98	40		18				59.25	-
·16	97	38		-					
·30	98	50 to 32		23°				71	3.
·35	98	2 - 2		-				71	-
·39	98	-		-				69.5	-
·47	98	100 to 80		28.30	20			89.5	4.
·50	98			-				89	-
·54	96			29°				86	-
16·7	94	100 to 80		28.30	27			97.5	5
·14	96			-				98	-
·8	94			-				97	-

Determination of λ

10 Complete swings in 350.75 secs = 35.075
1st double elongation 510.5 } λ = 0.05012 1+½λ = 1.025006
2nd " " 178

10 Complete swings in 316.5 secs = 31.65
1st D. E. 440 } λ = 0.05041 1+½λ = 1.025020
2nd " " 170

10 Complete swings in 314.9.5 secs = 31.495
1st D. E. 453 } λ = 0.04990 1+½λ = 1.024950
2nd " " 167

Mean T = 31.892 secs: Mean 1+½λ = 1.025000

$$\frac{T}{1+\frac{\lambda}{2}} = 31.04 \quad \log 1.53201$$

Qty of current in microcoulombs passing thro G:

05 Mean	2.56	0.018
0 "	2.75	0.020
20 "	5.62	0.041
40 "	10.17	0.074
0 "	26.25	0.190
5 =	37.81	0.275
0 =	50.18	0.3640
5 =	60.141	0.438
0 =	70	0.508
0 =	88.2	0.640
0 =	97.5	0.707

15)

Monday 6th February

Compared Ayrton & Perry Spring voltmeter with Clark cell. @ follows.

A + B are electric light mains
G delicate astatic galvo.
C Clark Mercury cell.

T 22·5°C.

2 gravity cells on Potentiometer. Reading of Standard cell 0·815

When A+B voltmeter indicated 95 volts the above arrangement gave balance at 0·551

@ 22·5° C 1 C.B. = 1·44455 B.A. volts = 1·44455 or 1·4295
1·0112.

legal volts ∴ 1·4295 X ·551 or 0·9658 was P.D.
·815

on 100 ω so that voltmeter on mains should have indicated 96·6 volts, actually showing 95 or 1·6 volts in deficit.

Determination of λ

10 complete swings made in 353 secs = 35·3 per swing

1st double oscillation 488·75 } λ = 0·05150 1 + ½ = 1·02575
2nd " 174·5 }

2nd 10 Complete swings made in 353·5 secs = 35·35 secs per swing

1st double elongation 474·25 } λ = 0·05181 1 + ½ = 1·02591
2nd " 168·25 }

Mean 1 + ½λ = 1·02583 + mean T = 35·325

35·325 / 1·02583 = 34·437 log = 1·537 02

Time	Magnetising Current. Volts	Amps	Amps	Tang.	Large T.	Dynam.	Swing	Multiplier 4 per cent	Ballistic Galv. Deflection	Q = in microcoulombs
14·33	97	1950	·05	21°			7	6	1·75	
·39	96	2050	·01	21°			"	"	3	0·0155
·44	96·5	2050	"	"			"	"	2·75	
·48	95	2050	"	"			"	"	1	
15·1	96·5	1010	0·1	37°30'			"	"	2	
·7	97	1010	"	"			"	"	3·75	0·0245
·12	97·5	1010	"	"			"	"	3·25	
·15	97	1010	"	"			"	"	3·25	
·22	96·5	490	0·2	56°			"	"	4·25	
·26	96	460	0·1	57°			"	"	4·75	0·033
·30	95	430	"	57°			"	"	4·5	
·39	97	See Tel. Temp	0·4	72°			"	"	9·0	
·45	97		"	72°			"	"	9·75	0·069
·50	95		"	72°			"	"	9·5	
·59	95	90	1·0		8°		"	"	23·5	
16·04	95	"	"		"		"	"	25	0·180
·9	96		"		—	—	"	"	23·75	
·13	95	"	"		"		"	"	24	
·20	97	60	1·5		12°		"	"	35·75	
·26	97	"	"		"		"	"	35	0·259
·31	96		"		"		"	"	35	
·40	96	47	2·0		16°		"	"	46	
·49	97	"	"		"		"	"	46·25	0·339
·54	97	"	"		"		"	"	46·5	
17·11	97·5	3 coils	2·5		19°		"	"	54·5	
·15	97	"	"		19°20'		"	"	57	0·408
·19	96	"	—		19°30'		"	"	58·5	
·24	96·5	16	3·0		23°		"	"	64·25	
·30	96	19	"		"		"	"	68	0·477
·35	96	19	"		"		"	"	63	
·41	95	30	4·0		29°		"	"	78·75	
·45	93	30	"		29°30'		"	"	80	0·584
·49	93	31	"		29°30'		"	"	80	
·54	93	40	5·0		35°30'		"	"	88	
·57	93	40	"		"		"	"	89	0·653
18·03	100	40	"		"		"	"	90	

16)

Tuesday 7th February

Took following measurement of magnet for pendulum.

Diam: of non cores 7.64 cms:

outer layer of wire 9.3 cms mean.

199 turns of wire go to a layer on each limb and on the left hand there are

n layers + 70 turns.

and on the right hand there are

n layers + 57 turns.

n is probably 5 so far as could be estimated at sight.

38.65 cms from end to end of coils:

diam of wire 0.065" = 0.165 cms

covered 0.075" = 0.190 -

Determination of λ as follows

1) 10 Complete swings completed in 314.625 secs
= 31.4.625 - per swing

1st double elongation 4449.5 divs } λ = 0.05014 1 + 1/2 = 1.02514
2nd " " 1614. }

2) 10 Complete swings completed in 3149.25 secs
= 314.925 - per s.

1st D. Elong: 470.5 } λ = 0.05127 1 + 1/2 = 1.02563
2nd " 168.75 }

3) 10 Complete swings completed in 3146 secs = 314.6 secs

1st D. Elong: 478.5 } λ = 0.05101 1 + 1/2 = 1.02551
2nd 175.75 }

Received from Mess Tarth & Washington D.C. —

1 Astronomical Clock
1 Chronograph
1 Plenimeter
1 Sphrometer
1 4" Equatorial with micrometer eyepiece
1 Spectrometer

Mean T = 314.717
- 14 1/2 = 1.02552
= 33.853

7° swing + 7 cms: interpolar dist:

Time	Volts	Ohms	C.	Summer Temp	Large Temp	Mercury Galv.	Dynamo Summer	Galliéro Thermo	Mean	a in microns
14·13	98	1920	0·05	21°	-	-	-	1·5		
·16	99	1920	-	-				1·5	1·31	0·009
·34	100	1800	-	-				1·0		
·46	87	1800	-	-				1·25		
·57	96	940	0·1	37·50'				3·5		
·59	97	950	-	-				2·25	2·5	0·018
15·09	99	930	-	-				2·25		
16·32	99	950	-	-				2·		
15·15	97	410	0·2	57°				4·75"		
·20	99	390	-	-				3·25	3·56	0·026
·23	100	410	-	-				3·0		
·27	99	390	-	-				3·25		
·50	94	1 Lamp	0·14	72'				5·		
16·02	95	1·25'	-	-				6	5·42	0·039
·7	95		-	-				5·25		
·27	97	82	1·0		8°	0·6	3	13·25	13·13	0·094
·37	90	82	-		-	-	-	13·		
·42	93	55	1·5		12°	0·9	14	23		
·52	94	-	-					21	21·33	0·153
·55	90·5	-	-					20		
17·00	89	25	2·0		16·30	1·14	9	29·25"	28·13	0·203
·06	86	40	-		16	-	-	27		
·14	98	[illegible]	2·5		19·30'	1·5	10	32·25	32·25	0·233
·18	95	-	-		-	-	-	32·25		
·24	93	69	3·0		23°	2·1	14	38		
·28	93	-	-		-	-	-	39	39·5	0·278
·32	92	45	4·0		24·30	2·7	19	48"		
·40	93	-	-		28·30	2·5	15	46·75	47·35	0·342
·45	94	40	5·0		35·30'	3·1	33	56		
·50	94	-	-		-	-	-	56	56·25	0·406
·53	94·5	-	-		-	-	-	56·75		

17)

Wednesday 8th February

Received from Messrs Queen & Co Phila. from Edelmann Munchen

1 Swinging Galv.
2 Bussolentometers (1 large 1 small pattern)
1 Alt: Galv for heavy current
2 Annulus & bollinetter coils.
1 Inclinatiometer.
1 Weidemann's ring galvs:
1 Unit Galv:

Determination of λ & T

1 { 10 swings completed in 352 secs = 35·2 secs per s.
{ 1st double elongation 501·25 } λ = $1+\frac{1}{2}$ =
{ 21st " " 176·25 }

2 { 10 swings completed in 349·5 secs = 34·95 secs per s.
{ 1st d. e. 452·5 } λ = $1+\frac{1}{2}$ =
{ 21st " " 160 }

3 { 10 swings completed in 350 secs = 35·0 secs per s.
{ 1st d. e. 498 } λ = $1+\frac{1}{2}$ =
{ 21st " " 176 }

Thursday 9th February

Unable to continue magnetic pendulum experiments owing to absence of dynamo current also broke ballistic suspension.

Galvanometer trial cover made.

Pendulum swing 7ft. Interpolar dist: 7·9 cms:

Time	Volts	Ohms	Magnetizing current: S. Tow.	Large Tow.	Dynos.	Mercury	C	Ballistic Throw	Mean	a in microcoulombs
0·31	88	1900	21°				0·05	1·75		
·44	96	-	-			-		0·5	1·19	·009
·48	99	-	-					1·5		
·53	97		-					1·0		
11·6	99·5	900	37·30'				0·1	1·75		
·14	97	-	-					1·5	1·62	0·012
·18	98	-	-					1·25		
·23	98	-	-					2·0		
·32	99	430	55°				0·2	1·5		
·36	97	440	56°				-	3·25	2·44	0·018
·39	99	410	57°				-	2·0		
12·2	97	410	57°				-	3·0		
13·47	97	No Dynos + Tow	72°				0·4	4·0		
·52	96		-				-	5·25	4·94	0·036
·59	96		-				-	5		
14·8	97		-				-	5·5		
·18	93	87		8°	2	0·7	1·0	13·25		
·24	96	87		-	-	-	-	11·25	11·98	0·086
·29	96	84		-	-	-	-	11·5		
·34	98	84		-	-	-	-	11·5		
·45	96	55		12°	3	1	1·5	17·25		
·52	93·5	53		-	-	-	-	19	17·44	0·127
·58	87	54		-	-	-	-	16·5		
16·22	92	54		-	-	-	-	17		
·07	89	40	-	16°	7	1·2	2·0	24		
·12	96	42		-	-	-	-	24	24	0·175
·24	96	70·42		19·30'	11	1·7	2·5	29·25	29·13	0·212
·29	96	-		-	-	-	-	29		
·32	94	62		23°	13	2·0	3·0	34		
·36	97	-		-	-	-	-	33	34·13	0·243
·42	94	-		-	-	-	-	33·25		
·49	96	50		28°30'	20	2·5	4·0	42·75		
·55	92	47		29°30'	-	-	-	44·25	44·4	0·320
·57	93	49		29°30'	24	2·6	-	44		
17·4	92	41		35°30'	32	3·1	5·0	49		
·9	100	41		36°30'	36	3·3	-	53·5	51·5	0·375
·13	98	41		35°30'	32	3·1	-	52		

Friday 10th February

No magnetic pendulum experiment made.

Experiment commenced with potash cells. (Lalande)

Cell no 1 (separate) was made up with 45 parts of Lewis Potash to 100 parts of water.

Cell no 2 (separate) was made up with equal parts of Lewis Potash + water.

Box no 1. of 4 cell was made up with ordinary potash solution similar to no1.

At noon Box no1 EMF approx 2.6 volts was set to work on a phys: motor whose res: was about 0.38 ω but at the running speed its equivalent resistance owing to counter electromotive force was about 1.7 ohms. As the res: was not constant owing to dirt collecting at the commutator the motor was removed and the 4 cells were connected for short circuit through two coils of total resistance 2.05 ω. at 11.4 o'clock.

The E.M.F of the 4 cell at that time was

2.270 volts or 0.568 per cell.

when about on 2.05 ω P.D = 1.894

Res: of 4 cell ∴ = 0.42 ω = 0.105 ω per cell

At 17 o'clock the P.D was 1.982. } R = 0.21 ω = 0.053 ω p.c.
- EMF 2.188

17.23 PD was 2.092

17.30 E MF of cell no 1. 0.948 volts
- - - - 2 0.8088 "

Saturday 11th February

10. am EMF of battery no 1. (4 cells) 2.802 volts
P.D. across 2.05 ω 2.092
Internal Res ∴ = 0.21 ω or 0.051 ω p.c.
C. = 1.02 amp.
Cell no 1 0.632 volts.
- - 2 found to have been left on short circuit by mistake. Fresh solution made up for it.
2nd obs: of cell no 1 EMF 0.620 ω
P.D. across 0.89 ω 0.592.
I. R. 0.023 ω

13.30 EMF of battery no 1 (4 cells) 2.368 volts
P.D. across 2.05 ω 2.164
C = 1.05 I. R. = 0.20 ω = 0.05 p.c.

EMF of 2 1/2 % cell. 0.614 ω
- - 50 % - 1.2 ω but still hot.

13.40 Battery no 2 (4 cells) made up with solution of Topham Potash (Alt: Halls water) put on circuit through 2.20 ω
EMF before doing so. 3.271 ω
P.D. immediately after " " across 2.2 ω 2.574
C. 1.17 amp. Internal res: 0.6 = 0.15 p.c.

Following trials were made with the new ballistic suspension

1st trial 10 complete vibs: in 355 secs = 35.5 secs per swing:
1st double elongation 44.1 divs: + 21st 112.75
Whence λ = 1 + 1/λ =

2nd do: 10 complete vibs: in 352.75 secs = 35.275 secs per swing
1st double elongation 48.1.75 divs + 21st 123.5
Whence λ = 1 + 1/λ =

3rd do. 10 complete vibs: in 354.25 secs = 35.425 secs per swing
1st double elongation 50 2.75 divs. + 21st 127.75 divs
Whence λ = 1 + 1/λ =

19) at the temp: of 21° C

The following discharges were observed from ½ ℓ charged by 1 B. A.

103·75
105
104
104
103
103 } Mean 103·8

The E.M.F. of 1 B.A. @ 21° C = 1·4447 B A volts:

$\frac{1.4447}{1.0412}$ = 1·431 legal volts.

qty discharged = 0·7155 mean coulombs:

16.30 Battery no 2 (4 cells) Lewis Toffman Potash.
P.D. across 2·20 ω = 2·272 v
EMF 2·612
C. = 1·03 amp. I.R. = 0·33ω = 0·08 p.c.

Battery no 1 (4 cells) Lewis Potash.
P.D. across 2·05 ω = 2·110 v.
EMF = 2·272 v
C. = 1·03 amp. I.R = 0·16ω = 0·04 p.c.

Cell no 1 31% + Cell no 2 50% put on circuit through 0·88ω (in series)
EMF no 1 0·656
P.D. 0·612 = 0·03
EMF no 2 1·188
P.D. 1·620 = 0·38ω
P.D. of both cells across 0·88ω = 1·254.
C. 1·43 I.R. 0·41ω

Monday 13th February

Lalande battery test. Found battery no 2 leaking

9.15 P.D. of battery no 2 across 2·2 = 0·580
EMF 1·248

P.D. of battery no 1 across 2·05 = 1·948
EMF 2·160
I.R. = 0·223ω C = 0·95 amp: EMF 2·160
= 0·056 p.c. = 0·54 p.c.

P.D. of cells nos 1 + 2 across 0·88ω = 1·206.
EMF = 1·504
I.R. of 2 cells 0·022 ω
P.D. of 31% cell = 0·574
EMF = 0·646
Res 0·052ω
P.D. of 50% cell = 0·640
EMF = 0·776
Res 0·097ω

14.0 P.D. of battery no 1 across 2·05 = 1·872
EMF 2·122
C = 0·913 I.R = ·273 = 0·063 ω p.c. = 0·53 p.c.

P.D. of cells 1 + 2 across 0·88 = 1·290
EMF = 1·420
I.R. 0·048 P.D. of cell no 1 31% = 0·574
C 1·37 amp EMF = 0·620
I.R. 0·088 P.D. of cell no 2 50% = 0·646
EMF = 0·76

17.0 P.D. of battery no 1. across 2·05ω = 1·824
I.R. 0·228 EMF = 2·246
C = 0·9 amps. Res 0·118ω p.c. EMF = 0·561 p.c.

I.R. 0·162 P.D. of cells 1 + 2 across 0·88 = 1·198
EMF = 1·410
I.R. 0·044 P.D. of cell no 1 31% = 0·564
C. 1·35 amp EMF = 0·628
I.R. 0·117ω P.D. of cell no 2 50% = 0·639
EMF = 0·798

20) The charge of the long magnet fell today to below 50% definitely after a lapse of time of 20 days. Its poles were removed and the time of a vibration of the needle in air was found to be 1.26 seconds.

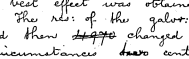
A long iron wire (105 feet charcoal wire rod) was laid outside the building in a long loop and its poles were brought in to the measuring apparatus through the window. It was magnetised first by bringing the short elec. magnet electrified by a gravity battery into contact with its poles. After removing the elec. magnet, no appreciable magnetism appeared to ~~be~~ remain in the 100 foot iron wire.

The long 80 foot elect: magnet was now excited by a current of about half an ampere from the dynamos and its poles placed in contact with those of the 100 foot iron wire clamped in the measuring apparatus. After removing the exciting poles no appreciable magnetism could by the time reading be detected in the iron wire.

Tried pyro-magnetic induction apparatus again.

A, B represent the pole pieces in plan of the short elec: magn: The coils C and D have in series a total res: of 36 ω. Iron pins projected as extensions from the cores, and wires or small plates could be laid across them. The Elec: magnet was excited by a gravity battery of 26 cells, the dynamo current being too variable. Wires from the coils C + D were led away to the delicate Thomson astatic galvanometer but its indications were from want of damping so troublesome to observe that the large deadbeat Wiedemann was connected up instead, and a telescope and scale distant 10 ft. This arrangement was not so sensitive but gave steady and definite indications. Nickel plated iron wire cobalt plated iron wire and sheets of nickel were tried across the extension E.F. The tip of a blowpipe flame from the jet + foot bellows was suddenly brought to bear upon the substance under trial midway between E and F. Deflections of about 1 or 2 cms were observed. The best effect was obtained with sheet nickel. The res: of the galv: coils was first 100 ω and then ~~4970~~ changed to 4970 under these circumstances ~~two~~ centimetres of deflection (1 div:) was found by measurement to represent 0.82 microwampères.

The best readings were 3 cms: with a strip of sheet nickel. The deflection rose slowly to a maximum apparently about a bright red heat and then fell off even though the heat was continued. On cooling equal or even greater deflections were observed on the opposite side. The curve of deflection in time might be estimated at something like this



This deflection of 3 cms corresponds to an EMF of nearly .007 volts. This was not always obtained but half that amount namely 0.0035 volts could always be relied upon.

21)

Tuesday 14th February

9.30 P.D. Battery no 1 across 2.85v = 1.596

180-236 EMF = 1.780

0.059/cl

C = 0.78 amps = 0.1445 pc.

P.D. Battery no 2 across 2.20v = 1.014

3.A=0.1463 EMF = 1.724

=.0857/c. C. 0.48 amps

3A = 0.1463 P.D. cells no 1 + 2 across 0.88v = 1.178

C = 1.34 EMF = 1.366

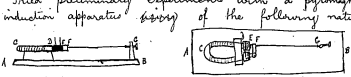
2A = 0.059 P.D. cell no 1 = 0.552

EMF = 0.628

1A = 0.103 P.D. cell no 2 = 0.622

EMF = 0.760

Tried preliminary experiments with a pyromagnetic induction apparatus ~~[illegible]~~ of the following nature



A solid iron bed plate AB has an electromagnet fixed at one end CD with 2 coils of wire (total res: 38v) on its ends, the projecting poles have a keeper EF hinged at one end and capable of being pulled off the pole at E by the tension of a wire at ~~stretched~~ between it and a column G with a screw head. By passing a current through the wire the expansion due to heat would allow the keeper to fall against the pole E but on taking off the current the contraction would pull it away. A galvanometer was connected with the ends of the wire from the coils DE. — (the large Wiedemann) — res: 5009. Different wires of iron, german silver, and brass were tried between F and G and the best results hitherto have been with the brass wire but the motion was sluggish. Deflections of the ~~[illegible]~~ mirror represented by 16 cms at 10 feet range (8 divs) were on expansion and closing magnetic circuit and 15 divs = 30 cms on breaking by contraction were observed. 10 Volts charged a ½ microfarad and the discharge was then thrown into the circuit (5 microcoulombs) It produced a throw of 2 divs = 4 cms. The magnet was excited with a current from about 36 cells of gravity battery and the wire FG received a current of something like 3 amperes.

The long electromagnet (50 feet) was cut into halves this morning and one ~~[illegible]~~ half was connected to the time vibration apparatus. a current from the dynamo through a lamp. (about ½ amp) was used to charge it. The number of vibs free was found to be 235 per 300 secs: = 1.276 secs. per vib = t_0

On charging, the right hand pole being the north seeking pole the number of vibs was 270 in 180 secs = 0.667 secs: per vib = t_m

∴ the constant = 61.20

The charging current was removed at 10.25 and immediately afterwards the time reading was observed. It amounted to 0.869 secs (245 in 300 secs) = 65.7%. say 3 mins after removal.

At noon the reading was 0.912 secs (329 in 300 secs) = 56.9% say 1 hour 35 mins.

At 16.25 the reading was 0.898 secs (334 in 300 secs) = 61.6%. 6 hours after.

16.0 I.R. 0.071 { P.D. battery no 1 across 2.05ω = 1.466
EMF = 1.660
C = 0.715 I.R. per c: 0.068ω = 0.415 p.c.

I.R. 1.25 { P.D. battery no 2 across 2.20ω = 0.976
EMF = 1.532
C = 0.444 I.R. per cell = 0.312ω = 0.380 p.c.

I.R. 0.037 { P.D. cells 1 + 2 across 0.88ω = 1.204
EMF = 1.40
C = 1.37

I.R. 0.044 { P.D. cell no 1 3% = 0.558
EMF = 0.618

I.R. 0.091 { P.D. cell no 2 50% = 0.644
EMF = 0.768

Wednesday 15th February

9.15. I.R. 0.366 { P.D. battery no 1 across 2.05ω = 1.294
EMF = 1.520
C = 0.63 I.R. p.c. = 0.092 = 0.380

I.R. 1.30 { P.D. battery no 2 across 2.2 = 0.956
EMF = 1.518
C = 0.435 I.R. p.c. = 0.335ω = 0.379

I.R. = 0.147 { P.D. cells nos 1 + 2 across 0.88ω = 1.160
EMF 1.35ω
C = 1.32

I.R. 0.042 { P.D. cell no 1 3% = 0.554
EMF = 0.610

I.R. = 0.099 { P.D. cell no 2 50% = 0.610
EMF = 0.740

The 40 foot magnet time period is 0.901 sec (333 = 5m) or % = 61.3% @ 24 hours

17.0 I.R. = 0.401ω { P.D. Battery no 1 across 2.05ω = 1.196
EMF = 1.430
C = 0.583 amp I.R = 0.10ω p.c. = 0.358

P.D. Battery no 2 across 2.2ω = 0.930
EMF = 1.450
since this battery was seen to be again leaking badly dismounted it

I.R. = 0.164 { P.D. of cells nos 1 + 2 across 0.88ω = 1.114
EMF = 1.322
C = 1.266

0.051 { P.D. of cell no 1 across 0.88ω = 0.586
EMF = 0.600

0.106 { P.D. of cell no 2 = 0.560
EMF = 0.694

Thursday 16th February

9.30 I.R. = 0.385 { P.D. battery no 1. across 2.05ω = 1.096
EMF = 1.302
C = 0.535 I.R. 0.086ω p.c. = 0.326

I.R. = 0.195 { P.D. of cells nos 1 + 2 across 0.88ω = 1.080
EMF. = 1.320
C = 1.227

0.031 { P.D. of cell no 1 = 0.562
EMF = 0.600

0.174 { P.D. of cell no 2 = 0.552
EMF = 0.766

The period of the 40 foot magnet is 0.917 secs or 327 in 5' = 59.26% @ 24 hours

Made up 2 cells (nos 3 + 4) of Topham potash
no 3 is 20% by weight of potash
4 - 33⅓ -
These cells in series and on circuit of 0.87ω at 14.0
EMF before working 3 + 4 = 2.288 3 = 1.068 4 = 1.168
After working 1 hour P.D across 0.87ω = 1.240 both ~~[illegible]~~
- = 0.658 (nos) at
- = 0.622 (nos)

23) The following is a summary of results obtained during the last few days with a pyro-cell using different metals and fusible salts.

A hessian crucible was heated over a naptha blast to bright redness and small plates were plunged into the fused substance in it under trial. Wires from the elements were led to the Electrometer.

14.2.88 Clark cell 28.5°C = 36.6 + 63.6 = 27.0

Nickel + carbon in $BaNO_3$

Carbon + element on heating = 49.5 − 54.5 = 5

= 0.271 volt.

Silver + carbon in $BaNO_3$

Carbon + element 47.8 + 53.5 = 5.8

= 0.308 volt.

Platinum + carbon in $BaNO_3$

Carbon + element 47.9 + 51.6 = 3.7

= 0.197 volt.

Iron + carbon in $BaNO_3$

very small + variable deflections unable to record them.

15.2.88 Clark cell 22.5°C. = 36.15 + 63.75 = 27.6

Nickel + carbon in Barium sulphuate.

Results quite unreliable as at highest temp. reached the salt remained unfused.

∴ Nickel positive element? = 54.5 + 46.8 = 8.7.7

Silver + carbon

carbon neg element? 48.5 + 51 = 2.5

Platinum + carbon

carbon neg. element? 48.8 + 52.5 = 3.7

Iron + carbon very small variable readings.

16.2.88 Boracic acid 14 gr. Clark cell 39.25 / 60.85 } 21.6

Nickel + carbon

Carbon + element, 49 + 51 = 2 = 0.133 volt

Silver + carbon

Carbon + element, 46 + 53 = 7 = 0.465 volt

Platinum + carbon (C.C. 27.6)

Carbon + element 46.8 + 54.8 = 8 = 0.415 volt

Iron + carbon (C.C. 21.6)

Carbon − element 47 + 52 = 5 = 0.332 volt

Plumbs: Boracic.

Iron + carbon volt

Carbon + element 49.85 + 50.2 = 0.35 = 0.024

17.30 0.2443 S.R. { P.D. battery no 1 across 2.05w = 1.068
E.M.F = 1.274

C = 0.521 EMF = 0.319 p.c. S.R. 0.10 p.c.

S.R. 0.444 { P.D. of cells no 1+2 across 0.88w = 0.918
E.M.F = 1.432

C = 0.104

P.D. of cell no 1 + also E.M.F. gero.

{ P.D. of cell no 2 = 0.725
E.M.F = 0.786

S.R. = 0.160 { P.D. of nos 3 + 4 across 0.87w = 1.242
EMF = 1.494

C. = 1.717 ~~S.R.~~ =

0.069 { P.D. of no 3 = 0.634
EMF = 0.734

0.091 { P.D. of no 4 = 0.628
EMF = 0.760

(234) Table shewing behaviour of Lalande cells.

Date.	Cell No.	Nature of Potash	Percentage in solution	Time from commencing	Res. in cct.	EMF p. cell	Sat. R. p. cell.	C: amp.	Remarks
10.2.89	Battery no. 1. in box.	Lewis.	20	Hours 0	2.05ω	0.568	0.105ω	0.91	83
-				3		0.567	0.05ω	0.97	88
11.2.89				20		0.575	0.05	1.02	1.04
-				23½		0.592	0.05	1.05	1.11
-				26½		0.568	0.04	1.03	1.05
13.2.89				67		0.540	0.06	0.95	91
-				72		0.530	0.06	0.91	8
-				75		0.561	0.12	0.90	8
14.2.89				91½		0.445	0.06	0.78	6
-				96		0.415	0.07	0.72	5
15.2.89				115		0.380	0.09	0.63	4.5
-				123		0.358	0.10	0.58	3.5
16.2.89				139½		0.326	0.09	0.54	2.5
-				147		0.319	0.10	0.52	2.5
17.2.89				163		0.284	0.13	0.44	1.9
-				170		0.278	0.11	0.44	1.9
				Taken down.					
11.2.89	Battery no 2 in box.	Topham	20	0	2.2ω	0.818	0.65ω	1.17	
-				2½		0.653	0.05ω	1.03	
		Leakage took place chiefly from one circuitry				all during this interval part or all of the battery			
13.2.89				43		0.312		0.26	
14.2.89		Replaced leaking cell with		~ fresh one					
				67		0.431	0.30	0.48	
				74		0.380	0.31	0.44	
				91		0.379	0.33	0.44	
				99		0.362	0.31	0.42	
		Battery here taken down. The result was probably considered unbelievable by the leakage which took place between Saturday evening and Monday morning as shewn above.							

Lalande battery of 2 cells

1 + 25 under same conditions with different solution

Date	Cell No.	Nature of Potash	% in solution by weight	Time of obs.	Hours from commencement	Res. in cct.	EMF of all cells	Sat. R. p. cell	C
10.2.89	1	Lewis	31	17.30	0	0.88	0.648		
11.2.89				10.	16½	0.-	0.620	-0.023	0.66
12.2.89				16.30	23	^	0.656	-0.030	1.43
13.2.				9.15	16¾		0.646	0.05	1.37
14.2.				14.-	21¾		0.620	0.05	1.37
15.2.				17	24½		0.628	0.04	1.35
16.2.				9.30	41		0.628	0.06	1.34
16.2.				16.	47½		0.618	0.04	1.37
16.2.				9.30	65		0.610	0.04	1.32
16.2.				17.	72½		0.600	0.05	1.27
16.2.				9.30	89		0.600	0.03	1.23
16.2.				17.30	97				
17.2.				9.30	113		Positive		0.80
							Negative		0.12
		Took this cell down and cut of circuit as it was quite exhausted and acted as a counter EMF by polarizing.							
18.2.89	2	Lewis	50	17.30	0	^	0.804		
19.2.89				16.30	0	^	0.788	0.38	1.43
20.2.				9.15	16¾		0.786	0.09	1.37
21.2.				14.0	21½		0.766	0.09	1.37
22.2.				17.0	24½		0.768	0.12	1.35
23.2.				9.30	41		0.760	0.10	1.34
24.2.				16.	47½		0.768	0.09	1.37
25.2.				9.30	65		0.760	0.10	1.32
26.2.				17.	72½		0.694	0.11	1.27
27.2.				9.30	89		0.766	0.17	1.23
28.2.				17.30	97		0.786	0.-	0.10
1.3.				9.30	113		0.964	0.18	0.12
2.3.				15.30	119		0.956	0.18	0.71
3.3.				9.30	137		0.712	0.25	0.65
4.3.				16.0	143½		0.736	0.29	0.63
5.3.				9.30	185		0.704	0.37	0.61
6.3.				17.	194½		0.678	0.38	0.57
7.3.				9.30	209		0.800	0.22	0.16

Cell no. 1 with all cells + 0.88ω

Cell no. 2 with all cells + 0.88ω

Friday 17th February

Pyro Cell results

Electrometer Clark cell 18.5°C. 60.95 / 39.75 } 21.8

Boracic of lead continued.

Nickel and Carbon no perceptible effect

Silver and Carbon

Carbon + element 49.5 + 51 = 1.5 = ~~0.007~~ volt

~~0.0015~~ volt = 0.1 volt

Platinum and carbon

Carbon + element 49.80 + 51 = 2.0

= ~~0.015~~ volt 0.133

Nitrate of copper

Cold and in liquid state.

Platinum + carbon

Carbon + element 46 + 53 = 7

= 0.46 volt.

Nickel + carbon

~~Iron~~ Nickel + element. 50.8 + 49.2 = 1.6

0.1 volt

Silver + carbon

Silver + element 51.4 + 48.7 = 2.7

0.18 volt.

Iron and carbon

Iron + element 52.1 + 47.4 = 4.4

0.29 volt.

Following time period was observed with the 40 foot magnet :—

8.15. 0.9119 secs (329 in 300 secs) = 59.92 %.

16.30 0.946 secs (317 - 300 -) = 55.44 %.

Leclanché batteries

R.L. 0.506 { P.D. of battery no 1. across 2.05 ω = 0.908
EMF - - - - = 1.134

C = 0.443 I.R. = 0.127 p.c. = 0.284 p.c.

R.L. = 3.26 { P.D. of cells nos 1 + 2 across 0.88 ω = 0.108
EMF - - = 0.594

C = 0.123

(Leclanché) { P.D. of cell no 1 - - - - = 0.
EMF - - = 0.

This cell evidently quite exhausted. Removed it, at 10 o'clock. This was the 31% Lewis potash. The ~~edge~~ lower corner of the zinc were but slightly consumed. They rested in a vertical slot with a hole horizontally through it.

R.L. 0.179 { P.D. of cell no 2 = 0.842
EMF - - - - = 0.864.

R.L. 0.122 { P.D. cell nos 3 + 4 across 0.87 = 0.258
EMF - - - - - = 1.434

C = 1.441

R.L. = 0.063 = 0.0490 { P.D. cell no 3 across 0.87 = 0.614
EMF - - = 0.705

R.L. = 0.059 { P.D. cell no 4 - - - = 0.644
EMF - - - = 0.729

Cell no 5 made of regular 31% Lewis Potash in tin outer cell (Soldered) instead of iron.

On cleaning out battery no 2 4 cells found as follows zinc Cell no 1 perf. support not at all

- - - 2 [illegible] " "

- - - 3 [illegible] no hole. bottom badly consumed

- - - 4 do. do.

15.30) Lalande battery continued

I.R. 0.145 { P.D. of battery no 1. across 2.05ω = 0.910
EMF = 1.110

C 0.4444 I.R. = 0.112ω p.c. = 0.298

As this battery was nearly exhausted, removed it at 16 o'clock.

I.R. 0.179 { P.D. of cell no 2. across 0.88ω = 0.628
E.M.F. = 0.756

C = 0.714

I.R. 0.174ω { P.D. of cells nos 3 + 4, across 0.87 = 1.250
EMF = 1.500

0.0450 { P.D. of cell no 3. = 0.612
EMF = 0.644

0.126ω { P.D. " " 4 = 0.620
EMF = 0.710

Cell no 5 set to work (15.20) on 0.94ω
EMF ~~before rotating~~ after 15 mins: work = 0.98

I.R. 0.384ω { P.D. across 0.94 = 0.696
EMF = 0.98

C = 0.74.

Pyro cell results 18th February C.E. = 60.890 / 29.55 } 21.05 @ 2.35

Nitrate of copper hot = $CuNO_3$

Iron and carbon.

Carbon is + element 53 / 147.8 / 52 } = 0.355 volt

Nickel and carbon

Nickel is + element 48 / 53 } = 0.341

Silver & carbon

Silver + element 49 / 51.5 } 2.8 = 0.191

Saturday) 18th February

Period of 40 foot magnet 0.943 secs = 318 in 30 secs = 55.4 %

Some copper wires of different diameters were immersed in CS_2 in which sulphur had first been dissolved. The tube was corked and set aside labelled.

Some copper wires of different diameters were cleaned and immersed in a weak solution of bromine. The tube was corked, labelled and set aside.

I.R. 0.30 { P.D. of cell no 2. across 0.88ω = 0.570
0.360 EMF = 0.732

C = 0.648

I.R. 0.101 { P.D. of cells nos 3 + 4 across 0.87ω = 1.028
EMF 1.148

C = 1.182

I.R. 0.039 { P.D. of cell no 3 = 0.600
EMF = 0.644

I.R. 0.061 { P.D. of cell no 4 = 0.610
EMF = 0.682

I.R. 0.157 { P.D. of cell no 5 across 0.94ω = 0.660
EMF = 0.766

C = 0.702

I.R. 0.24 / 0.297 { P.D. of cell no 2 across 0.87 = 0.558
EMF = 0.736

C = 0.634

0.029 { P.D. of cells nos 3 + 4 = 1.210
EMF = 1.334

C = 1.390

0.039 { P.D. of cell no 3 = 0.590
EMF = 0.644

0.0553 { P.D. of cell no 4 = 0.622
EMF = 0.696

I.R. 0.157 { P.D. of no 5 = 0.672
EMF = 0.784

C = 0.715

27) Monday 20th February.

8.15 Time period of 40 foot magnet = 0.956 (314 in 300)
= 54.15 %.

Battery no 1 cleaned out.
Oxide completely exhausted.
Solution thoroughly crystallized, and in one solid mass.

Cell no 1. H (peg) zinc corners not eaten.
- - 2 do do. just commenced to consume
apparently because peg was too close to side of holder.
- - 3 H (holes) not eaten.
- - 4 H (peg) not eaten.

9.20 P.D. of cell no 2. across 0.88 = 0.538
Int. 0.027 EMF = 0.704
C = 0.611

Int. = 0.091 P.D. of cells no 3 + 4 across 0.87 = 1.166
EMF = 1.288
C = 1.340

0.043 P.D. of cell no 3 = 0.560
EMF = 0.618

0.046 P.D. of - 4 = 0.580
EMF = 0.642

0.133 P.D. of cell no 3 across 0.94 = 0.648
EMF = 0.740
C = 0.689

17. 0.025 P.D. of cell no 2 - 0.88 = 0.502
EMF = 0.678
C = 0.570

0.116 P.D. of cells no 3 + 4 across 0.87 = 1.124
C = 1.292 = 1.274

0.051 P.D. of cell no 3 = 0.542
EMF = 0.605

0.063 P.D. - 4 = 0.564
EMF = 0.634

0.122 P.D. of cell no 5 - 0.94 = 0.632
EMF = 0.714
C = 0.672

Table shewing fall of charge in 40 foot Electromagnet.

No. of Obs:	Date	page of book	Time of day	Hours from Commencement	Periodic Time	Percentage Charge.
1	14th Feby.	21	10.25	0	1.276	0
2	- -	-	-	0	0.667	100 %
3	- -	-	10.28	0.5	0.869	65.7
4	- -	-	12.0	2.2	0.912	56.9
5	- -	-	16.25	6	0.898	61.6
6	15 -	22	10.30	24	0.901	61.3
7	16 -	-	10.00	48	0.917	59.3
8	17 -	25	9.15	70	0.912	59.9
9	-	-	16.30	78	0.946	55.4
10	18 -	26	8.20	94	0.943	55.4
11	20	27	8.15	122	0.956	54.2
12	20 -	28	17.30	131	0.968	52.59
13	21 -	28	8.0	146	0.990	49.92

Fall of charge with 20 foot magnet.

1	21.2.88	30	13.50	0	1.219	0
2	-	-	-	0	0.525	100
3	-	-	13.55	0.3	0.739	62.58
4	-	-	14.50	1.0	0.755	60.5
5	22.2.88	31	9.0	19.	0.789	56.19
6	-	-	17.40	28.	0.831	46.46

28)

Lyes cell results.

Clark cell $A = 61.5$, $B = 39.15$ } 22.35

Hot nitrate of copper $CuNO_3$

Platinum + carbon = 51
Carbon + element. = 48.5 } 2.5 = 0.160 volt

Barium hydroxide BaH_2O

Silver and carbon = 56
Carbon + element 45 } = 11 = 0.706 volt

Nickel and carbon = 53
Carbon + element 43 } 10 = 0.642 volt

Iron and carbon = 51.9
Carbon + element 45.75 } 5.15 = 0.330

Platinum + carbon = 52.5
47.5 } 5 = 0.321

At 17.30 the period of the long magnet was 0.968 (196 in 180 secs) or 52.5 %

Tuesday 21st February

The periodic time of the 40 foot magnet = 0.990 sec (303 in 300) at 8 o'clock = 49.82 %.

9.30 P.D. of cell no 2 across 0.8Ω = 0.138
I.E. 0.244 EMF = 0.808
C = 0.157

0.122 { P.D. of cells nos 3 + 4 across 0.8Ω = 1.07
EMF = 1.22
C = 1.230

0.065 { P.D. of cell no 3 = 0.494
EMF = 0.574

0.065 { P.D. 4 = 0.550
EMF = 0.620

0.097 { P.D. of cell no 5 = 0.94 = 0.620
EMF = 0.684
C = 0.66

~~P.D.~~ Cell no 6. made up with fresh oxide but solution ~~same~~ is that taken from cell no 1. after exhaustion.

Cell no 7 made up with 20% Saponifier potash.

Cell no 8 - - 33⅓ % Saponifier potash.

At noon the following observations were taken before the cells did any work.

1.25ω { P.D. of cells 7 + 8 across 0.95ω = 1.324
EMF = 2.330

0.662 { P.D. 7 = 0.680
EMF = 0.918

0.592 { P.D. 8 = 0.626
EMF = 0.970

Cell no 6. before doing any work

0.20ω { P.D. across 1.05ω = 0.584
EMF = 0.690

29) Table showing behaviour of Lalande cells.

Date	Cell No.	Nature of Cell	% of KHO by weight in solution	Time of obs:	Hours of commencement of work	EMF	S.R.	C.	Internal Energy C×R.	R.
16.2.88	3	Tiffen	20%	14·0	0	1·068				
16·2				14·30	½			1·425	1·717	0·87
16·2				17·30	3	0·734	0·07	1·717	2·89	0·71
17·2				9·30	19½	0·705	0·06	1·441	1·80	0·78
17·2				16·0	26	0·644	0·05	1·437	1·80	0·41
18·2				9·30	43½	0·644	0·04	1·182	1·21	0·67
19·2				16·0	50	0·644	0·04	1·390	1·68	0·67
20·2				9·30	91½	0·618	0·04	1·340	1·56	0·65
20·2				17·0	99	0·608	0·05	1·292	1·45	0·61
21·2				9·30	105½	0·574	0·07	1·230	1·31	
21·2				17·0	123	Exhausted				
16·2·88	4	Tiffen	33·3	14·0	0	1·168				
16·2				30	½			1·425	1·767	0·87
16·2				17·30	3	0·760	0·09	1·717	2·28	1·0
17·2				9·30	19½	0·729	0·06	1·441	1·80	0·78
17·2				16·0	26	0·710	0·13	1·437	1·80	0·83
18·2				9·30	43½	0·682	0·06	1·182	1·21	0·81
18·2				16·0	50	0·646	0·05	1·390	1·68	0·73
20·2				9·30	91½	0·642	0·05	1·340	1·56	0·69
20·2				17·0	99	0·634	0·06	1·292	1·45	0·68
21·2				9·30	105½	0·620	0·10	1·230	1·31	
21·2				17·0	123	0·574				
22·2				9·30	130	0·614	0·11	0·581		
		Cell commenced to leak badly, Removed it.								
		but not exhausted								

Date	Cell No	Nature of Cell	% of KHO by weight	Page of record	Time of Obs:	Hours after commencing	EMF	S.R.	C'	C'+R	R
16.2.88	5	Lewis	31%	25a	15·30	0	0·980	0·384	0·74		0·94
16·2·88	-	-	-	26	9·30	18	0·766	0·157	0·70		-
16·2·88				-	16·0	22½	0·780	0·157	0·715		
16·2·88				27	9·30	66	0·740	0·133	0·689		
17·2·88				-	17·0	73½	0·714	0·122	0·672		
17·2·88				28	9·30	90	0·684	0·097	0·660		
18·2·88				30	17·0	97½	0·700	0·150	0·666		
18·2·88				-	9·30	114	0·676	0·101	0·649		
19·2·88				31	16·30	121	0·675	0·062	0·657		
19·2·88				32	9·30	139	0·652	0·098	0·634		
20·2·88				33	10·30	163	0·652	0·090	0·627		
20·2·88				33	17·45	170	0·649	0·110	0·649		
21·2·88				35	9·10	186	0·670	0·096	0·647		
21·2·88				35	16·0	193	0·642	0·096	0·623		
22·2·88				36	8·30	233½	0·640	0·108	0·610		
22·2·88				36	17·0	242	0·637	0·093	0·630		
23·2·88				38	8·15	257	0·636	0·133	0·891		
23·2·88				-	17·30	266½	0·635	0·096	0·617		
24·2·88				39	8·30	281½	0·646	0·080	0·634		
24·2·88				39	17·30	290	0·638	0·078	0·638		
27·2·88	6	Lewis	Sodium Hydrate Dry Cell	28	12·0	0	0·690	0·20	0·574		
27·2·88				30	17·0	5	0·620	0·15	0·5014		
28·2·88				30	9·30	21½	0·186	—	—		
					Cell exhausted						

30)

17.0. P.D. of no 2 across 0.88 = ·240
EMF ·772

Found cell no 3 had failed

P.D. of cell no 4 across 0.87 = 0.644P
EMF . . . = 0.874

0.111 { P.D. of cell no 5 across 0.94 = 0.626
EMF 0.70
C = 0.666

0.150 { P.D. of cell no 6 - 1.08 = 0.544
EMF 0.620
C = 0.504

0.164 { P.D. of cells nos 7+8 - 0.95 = 1.236
EMF = 1.450
C = 1.30

0.075 { P.D. of cell no 7 = 0.610
EMF = 0.708

0.072 { P.D. of cell no 8 = 0.606
EMF = 0.742

but the 40 foot magnet into halves.
Put one 20 - - into the measuring apparatus
at 13.50 Magnetized it from the dynamo current.
The period was then 0.525 — 100% charge.
- - in air free was 1.219 — 0 - -
- - at 13.55 was 0.739" (40% in 300) = 62.50%
- - - 14.50 - 0.755 (397 - -) = 60.5%
- - - 15.50 - 0.767 (391 - -) =
- - - 16.50 - 0.759 (395 - -) =

Pyro cell. E.C. = 21.3

Platinum + carbon in hydrate of barium
carbon + element 47/58 } 6

Platinum + carbon in glacial phosphoric acid
carbon + element 47/58 } 6

Schoo + carbon
Carbon + element 47/58 } 6

Wednesday 22nd February)

9.30 Cell no 2 exhausted } both removed.
- - 3 -

0.113 { P.D. cell no 4 across 0.87 0.546
EMF ~~0.870~~ 0.614
C = 0.581

0.101 { P.D. cell no 5 - 0.94 0.610
EMF 0.676
C = 0.649

Cell no 6 exhausted. EMF 0.186.

0.12 { P.D. of cells nos 7+8 0.95 1.200
EMF 1.352
C = 1.26

0.044 { P.D. of cell no 7 0.612
EMF 0.668

0.045 { P.D. of cell no 8 0.542
EMF 0.660

Took the 2nd style phonograph, and worked it without governor. (meeting res: in the battery circuit until the current just enabled 80 revs: of the main shaft to be attained. When this was done, the P.D. across a 3 ft length of brass wire was measured & found to be 0.307 volts. The res: of the wire being 0.11445 ω the working current = 2.12 amp. The P.D. across the motor terminals being 2.620 volts the equivalent res: at that speed = 1.23 ω.

Similarly the current needed to work the old pattern motor was 1.84 amp, and to work the new model 2.53 amp.

31/16.30 P.D. of cell no 5 across 0.944 w = 0.618
0.062 EMF . . . . . = 0.678
C = 0.657

0.104 P.D. of cell no 7. + 8 across 0.95 = 1.220
EMF . . . . . = 1.354
C = 1.284

0.032 P.D of cell no 7. = 0.620
EMF . . . = 0.660
0.068 P.D. of cell no 8 = 0.610
EMF . . . = 0.696

The period of the 20 foot magnet was 0.789 at 19.00. (380 in 300") = 56.19 %
The period at 17.40 was 0.831 –
(361 in 300) = 46.46 %

Pyro cell results. Clark cell = 59.5
28.1
21.4

Glacial phosphoric acid.
Nickel + ~~carbon~~
Carbon neg: element. 46.8 } 7
53.8
= 0.47 volt.

Iron + carbon
Carbon neg: element = 46.8 } 6.7
53.5
= 0.45 volt

Potassium sulphide = K_2S
Platinum + ~~carbon~~
No perceptible effect

Nickel and carbon 48 } 4
Carbon neg: element 52
= 0.27 volt.

Iron and carbon
Carbon neg element 49.5 } 1
50.5
= 0.068 volt.

Silver and carbon. 47.5 } 5
Carbon neg: element 52.5
0.338 volt.

Ammonia hypophosphoric.
Ignited under heat and experiment had to be stopped.

Chromate of lead. 49.5 } 1
Platinum + carbon 50.5
Platinum + carbon neg: element 0.068 volt.

Silver + carbon
Carbon negative element 49 } 2
51
= 0.136 volt

Thursday 23rd February

0.0980 { P.D. of cell no 5 across 0.94 = 0.596
EMF . . . . . = 0.658
C = 0.634

0.1160 { P.D. of cells nos 7 + 8 across 0.95 = 1.168
EMF . . . . = 1.310
1.229 amp.

0.0340 { P.D. of cell no 7 across 0.95 = 0.606
EMF . . . . = 0.666

0.0610 { P.D. of cell no 8 . 0.95 = 0.572
EMF . . . . = 0.648

Cell no 2 dis mounted zinc very slightly consumed at the corners.
Cell no 4 On account of leakage was not exhausted and a considerable amount of oxide remained unreduced. Zinc not consumed at corners H pcg.
Cell no 3. zinc not consumed at corners about ½ good oxide left unreduced in gel.
Cell no 6. only the solution exhausted which is largely crystallized.

Pyro cell. Blank cell 14°C = 60·6 / 39·6 } 21.

Chromate of lead. / Nickel + carbon } 51·5 / 48·8 } 2·7 = 0·185 volt
Carbon + element

Iron + carbon / Carbon + element 50·5 / 49·5 } 1 = 0·068 volt

Potassium sulphate K_2SO_4

Platinum + carbon
On first applying heat carbon slightly neg:
On increasing heat changed gradually to pos:
At bright white heat Carbon + element 602 / 394 / 208 = 1·400 volt.
Res: was found to vary) between 1700 + 2000 ω
dimension immersed C. not ½" diam 1"
Pt plate ⅜" broad 1" about
dist: apart abt ½" (mean)

Iron + carbon.
Carbon + element 52·5 / 47·5 } 5 = 0·35 volt

After crucible got hot rose to 46 / 84 } 8 = 0·56 volt

33)

Friday 24th February

The 20 foot magnet was cut into halves and one of the 10 foot lengths so formed was clamped into the machine.

The period of the needle in air was found to be 1.190 secs (252 in 300 secs)

The current was put on at 9.0. and the period was then 0.591 secs (500 in 300) at 9.5 the current was removed and the period found to be 0.789 secs (380 in 300). = 65.17%

At Noon the period was 0.795 (377 in 300) = 63.74%

at 14.30 - - - 0.800 (375 - -) =

Date	Time of Obs	10 page	foot Mass for Commutating	Magnet Tie of size on 5"	Period of one obs	% of chap.	Constant
24.2.88	9.0	33	0	508	0.591	100	57.26
- -	9.5	-	0	380	0.789	65.17	
- -	10.00	-	1.	381	0.78		
- -	12.0	-	3	377	0.795	63.74	
- -	14.30	-	5½	375	0.800		
25. 2.88	8.10	—	23	374	0.802		
- -	11.10	—	26	367	0.817		
- -	14.30	—	29	364	0.824		
	16.0	—	30½	370	0.811		
27. 2.88	8.40	—	72	313	0.950		
- -	Noon	—	75	317	0.946		
- -	12.40	—	80	316	0.949		
28. 2.88	9.30	35	0	252	1.181	0	Constant
	25		0	235	.557	100	55.05
	50		0	403	.746	67.76	
	11.0		1½	392	.765	64.64	
	12.0		2½	389	.771	63.75	
	13.10		3½	406	.740	66.37	
	14.0		4½	400	.750	66.96	
	15.0	-	5	395	.759	66.22	
	16.0		5	396	.758	65.44	
	17.0		5	397	.755	65.44	
29. 2.88	9.10		22½	388	.773	63.58	
	12.0		26	385	.779	63.02	
	17.30		31½	385	.779	63.02	
1. 3.88	9.10		46½	374	0.802	59.36	

Calande battery.

16.30. 0.090 { P.D. of cell no 5 across 0.94 = 0.590
EMF - - - - = 0.652
C = 0.627

0.100 { P.D. of cells nos 7 +8 across 0.95 = 1.130
EMF . . . . = 1.258
C = 1.19 amp.

0.050 { P.D. of cell no 7. - - = 0.585
EMF . . . = 0.654

0.060 { P.D. 8 - - - - = 0.492
EMF - - - - = 0.566

17.45

0.100 { P.D. of cell no 5 across 0.94 = 0.610
EMF - - - = 0.675
C = 0.644

0.128 { P.D. of cells nos 7+8 - 0.95 = 1.172
EMF . . . = 1.33
C = 1.234 amp.

0.062 { P.D. of cell no 7 - - = 0.570
EMF . . . = 0.646

0.058 { P.D. of cell no 8 = 0.592
EMF . . . = 0.660

Measured res of certain lengths of wire for phonograph battery as follows.

Red yellow 18 feet 0.04.

No.	Diameter of strand	Colour of cord	Length of double foot	Res of single foot in ohms	Res of single foot in mil	Res of double foot in ohms	Res of double foot per mil	Res of single foot per mile	Res of double foot per mile
	0.075	red yellow	18 feet	0.0912	.00807	.01014			
2	0.037	green yellow	19.83"	0.0370	.00180	.00372			
3	0.160	scarlet	17.33"	0.0126	.00073	.00146			
4	0.193	purple	15.6"	0.0076	.00049	.00098			
5	0.312	green	17.08"	0.00[illegible]	.00025	.00050			

314)

Pyro Carbon cell

Barrett cell 1·1 volt = 58 / 41·8 } 16·2

Potassium sulphate + nickel + carbon

After first melted C neg. but gradually changed to pos: as C reached white heat.

C + 53 / 47·5 } 5·5 = 0·37 volt

Silver + carbon

at first got swing of 59

decreasing to 51.

increased again to 54 / 45·75 } 8·25 = 0·56 volt

Tried mixture of equal parts KHO caustic potash + sulphate of potassium K_2SO_4 with platinum + carbon

Everything cold. C + 52 / 48 } 4 = 0·27 volt

after heat applied 44 / 52 } 8 = 0·55 -

C became -

Gradually altered sign as mass became liquid and carbon became red hot.

ultimately C + 52·5 / 47·5 } 5 = 0·34 volt

Tried 5% caustic potash ultimately 55 / 45 } 10 = 0·68 -

- 10% caustic potash ultimate 55 / 45 } 10 = 0·68 -

Internal Res: 110 ω.

Elements immersed 2" in mass

Repeated measurement with simple K_2SO_4

Carbon + 61·25 / 38·75 } 22·5 = 1·53 volt

Res: 450 ω.

K_2SO_4 with 10% volume approx Boracic acid.

61·5 / 38·4 } 23·1 1·57 volt

I.R. 220 ω

Chemical hardened into crusty mass under heat

Tried 33% volume approx Boracic acid.

Ultimately C + 61· = 11×2 = 22

= 1·5 volt

I.R. 150 ω (about).

Chemical in dry hard lumpy state.

Tried 50% vol. Boracic acid

Ultimately C + 62 = 12×2 = 24

1·6 volt

I.R. 110 ω.

On pressing down chemical which had assumed (gummy) in pasty form res: reduced to 60 ω.

Tried 7.

Saturday 25th February

9.10. 0.096 P.D. of cell no 5 = across 0.94 = 0.608
C = 0.647 EMF = 0.670

0.124 P.D. 7.18 − 0.95 = 1.118
EMF = 1.298
C = 1.208 amps.

0.055 P.D. 7 = 0.566
EMF = 0.632

0.063 P.D. 8 = 0.566
EMF = 0.642

16.0 P.D. of cell no 5 across 0.94 = 0.586
EMF = 0.644

0.114 P.D. of cells no 7 + 8 − 0.95 = 1.122
EMF = 1.262
C = 1.180 amps.

0.079 P.D. of cell no 7 = 0.550
EMF = 0.596

0.109 P.D. of cell no 8 = 0.556
EMF = 0.620

Removed cell no 7 as it was found to leak.

Took test of Mr Simms coil of wire in barrel of water 999 feet.
Constant.
Most delicate astatic Galvo of Troy: Res. std. = 7584
50 Barrett cells 100,000 "
Shunt 40 " 127.5 divs =
24302 divs with 0 shunt = 24.30 divs per Ω
about 1 div. leakage on lead
On cable 1½ " or 3 mo: abt ½ div = 48600 Ω
= 8000 Ω per
Earth plate placed in water, and connected to instruments.

Put on 5 reversals from 1200 volts lasting about 1 min in all.
Insulation found O.K. after it.
Left —, Dynamo 1200 volts on cable for 2 hours.

Ehren meter commenced registering at 8.50.
1.85 amps: on indicator (120 volts. 15 lamps) zero = 09277
13.8 o'clock 09300 } 1.80 amp.
17.5 = 09321
8.50 to 17.5 = 8.25 hours 8.25 × 1.8 = 14.85 amp. hrs
09321 − 09277 = 44 = 0.3275 constant.

Pyro cell.
1 Aghl = 1.082 volts = A 58.3, B 41.9 } 16.44

Potassium sulphate + 75% (approx) Boracic acid.
Platinum + carbon. 54.3 } 8.6 = 0.550 volt
carbon + element.
Boiling at low temp:

Potassium sulphate + 60% approx Boracic acid
Platinum + carbon A 56.8, B 43.8 } 12.2 = 0.800 volt.
carbon + element
J. R. 70 " Fluid boiling

Potassium sulphate + 25% Glacial Phosphoric acid
Platinum + carbon 53, 47.2 } 5.8 = 0.38 volt
Carbon + element
J. R. about 10 "

Not being satisfied with results obtained from last full charge of 10 foot magnet tried again.

36)

Monday 27th February

Following tests were taken of the 1000 foot length of torpedo cable.

Dimensions as follows

Inner conductor of 7 wires each 0.025
Diam. of strand 0.102 d
Diam of g.p. covering 0.175 D
Outer conductor of 18 wire each 0.036
Diam of strand + inner core 0.247 d
Diam. of g.p. covering 0.370 D
Diam. of external braiding overall 0.425.

Resistance per yard { C.R. of inner conductor 2·30ω
- - - outer - 0.143ω } T. 28° F. water.

Capacity of Inner core outer core free.
Thomson method Balance $\frac{0.4014}{1}$ $\frac{250}{2000}$ = ~~0.0625~~ 0.0505 f

Capacity of Inner core outer core earthed.
Balance $\frac{0.4014}{1}$ $\frac{353}{2000}$ = ~~0.0883 f~~ 0.07131 f

Capacity of outer core inner core free.
Balance $\frac{0.4014}{1}$ $\frac{842}{2000}$ = ~~0.2105~~ 0.21168 f

Capacity of outer core inner core earthed.
Balance $\frac{0.4014}{1}$ $\frac{1197}{2000}$ = ~~0.2993 f~~ 0.24178 f

Gave 3 reversals of 1200 volts to smaller conductor using outer one as one armature i.e. inner conductor ± outer insulated conductor ∓.
Sparks on charging and smart shock on discharging through the body.

Insulation by Thomson Electrometer and Fall of charge 5 hours.
Inner core: Outer core earthed.
Charged 60" Full potential 91·7

Time	First trial		Time Insulated	Second Reading	Trial
10	91·3	Charge lost in	1'	91·3	Charge lost in
20	91·05	300 secs = 1·15	2'	91·05	300 secs = 1·45
30	90·85	Abs. 3,333,333	3'	90·75	Abs. 2,333,333
40	90·7	~~2,333,333~~	4'	90·5	2,333,280 a
50	90·55	= 3,142,857 a pkt. = 50,240 a pm. = 3,350 a pm/a	5'	90·25	= 35,840 a pkt. = 573,440 a pm. = 3,820 a pm/a

Outer core. Inner core earthed.
Charged 60" Full potential 91·7

Time	First trial		Time Insulated	Second Reading	Trial
10	90·8		1'	91·0	Charge lost in
20	90·1	Rejected, as	2'	90·30	300 seconds =
30	89·4	after using lamp	3'	89·70	~~2,333,320~~
40	88·7	flame as much	4'	89·50	2,333,320
50	88·1	slower.	5'	88·80	= 28,210 a h. = 4,640 a pkt. = 5,420 pk. to pm. = 3,360 a pm. per hour

Used alcohol lamp flame between 1st + second trials to reduce leakage over free surface g.p.

Calibration Battery.

5·30	0·108ω	P.D. of cell no 5 across	0·94ω	= 0·574
		EMF		= 0·640
		C = 0·670		
10·0	0·108ω	P.D. of cell no 8	0·95	= 0·572
		EMF		= 0·632
		C =		
11·7	0·143	P.D. of cell no 5	0·94ω	= 0·592
		EMF		= 0·650
		C = 0·630		
	0·076ω	P.D. of cell no 8	0·95	= 0·596
		EMF		= 0·644
		C = 0·627		

Table showing particulars of cells come from measurement.

37	Inner Core		Outer Core.	
Calculated weight of Copper per knot + mile	Diam. 0·102 WC per kt 104 lbs. WC per mile 90 lbs.		12 wires each 0·032, WC per kt 423 WC per mile 370	Diam 0·314 / Diam 0·370
Calculated weight of G.P. coating per knot + mile	Diam 0·118 WC per kt 41·2 lbs WC per mile 36·4		154·6	136·8
Conductor resistance at 100° Fah. 0·0559	2·30ω			0·430ω
G.R. per knot + mile at 70°	Knot. 15·00ω	Per mile 13·25ω		2·820ω 2·49ω
Capacity work Dubrovine cable	0·0882 ⊕			~~0·2495~~
Capacity per knot + mile	Per Kt 0·5371 ⊕	Per mile 0·4750 ⊕		~~1·8244~~ ~~1·6124~~ 1·6147 1·277
Specific Capacity cable Kt.	~~0·0360~~ ⊕ 0·0362			0·0981 ⊕
Loss by leakage in 5 min 60 Volts	1·41 %			3·49 %
Calculated time of fall to half charge	27½ mins.			97½ mins
Insulation of 1000 feet at 68° Fah. 100 Volts	333,400 Ω			~~28,200~~
Insulation per knot + mile	Per Kt ~~[illegible]~~	Per mile ~~[illegible]~~		Per Kt Per mile
Insulation per knot + mile @ 70° Fah.	Per Kt ~~[illegible]~~ 3,160 Ω	Per mile 3,350 Ω		
Insulation of 1000 feet at 70° Fah. cable	~~[illegible]~~ ~~[illegible]~~	~~[illegible]~~ ~~[illegible]~~		34,936 ~~[illegible]~~
Insulation per knot + mile at 70° Fah.	Per Kt ~~[illegible]~~ 2,500 Ω	Per mile ~~[illegible]~~ 2,900 Ω		582 Ω ~~[illegible]~~ Ω 660 Ω ~~[illegible]~~ Ω
Spare line: to 70° Fah.	~~[illegible]~~ Ω			380 Ω 380 Ω
Current obtainable for Four Thru. wire				~~[illegible]~~ ~~[illegible]~~
Res: of 1 cm.				40 amps
Heat generated per sec:				1.522×10^{-5}
				1.45×10^{-3}

Barrett cell 1·082 = 58 / 41·6 } 16·4.

Potassic sulphate with 10% Glacial phosphoric acid

Platinum + carbon. = 60 / 40 } 20 = 1·314 lead.

I.R. = 18ω including chemical paste.

Potassic sulphate with 6% Glacial phosphoric acid

Platinum + carbon. 60·1 / 39·9 } 20·2 = 1·32 volts

I.R. = 27ω.

61·5 was pot: reached when carbon broke

Potassic sulphate with 20% Glacial phosphoric acid

Platinum + carbon ~~53~~ / 47 } 6 = 0·394

I.R. not taken.

Tuesday 28th February

Barrett cell 1·082 volts 58·35 / 41·85 } 16·50

Potassic sulphate with 10% Glacial phosphoric acid.

Platinum + carbon = 58 / 40·5 } 17·5 = 1·15 volt

I.R. 17ω including lead increasing to 18ω.

Sodium sulphate —

Platinum + carbon. = 52·5

Decomposed before reading could be accurately obtained.

Sodium sulphate with 10%. Boracic acid.

Platinum + carbon =

Decomposed and boiled over with moderate application of heat.

Experiments were made with the Pyro Magnetic Inductor mentioned on page 21 with the following result.

The current flowing through the working brass wire was observed on the Electrodynt to be 4·05 amp. The P.D. between the end of the working wire was observed to be 1·4448 volts ∴ the work done per second was 4·05 × 1·4448 = 5·8644 joules.

The average time required to make contact at the pole was found from a mean of 8 obs: to be 16·4 seconds ∴ The total work done on the wire was 5·8644 × 16·4 = 96·2 joules.

The throw of the galvanometer needle in the circumpolar coil circuit was seen on the average to be 6·0 divs on making and 9·35 divs on breaking.

10 Ingle cells charging ½ ℓ and this charge thrown into the circuit gave 3·4 divs. ∴ 9·35 divs = 1498 microcoulombs of electricity. The time during which this discharge took place was not measured ∴ Assuming it to have been say $\frac{1}{100}$th of a second the ~~total~~ current so produced would be 1498 microcoulombs per sec = 0·0015 amperes. The Res: of the circuit being 5040 ω = 7·560 volts. In that case the energy delivered to the circuit would be $7.560 \times 15 \times 10^{-6}$ joules = 0·000113 joules.

It will be necessary to measure either the EMF of the induced charge or the time through which it flows.

Not being satisfied that last full of charge test on long magnet, repeated as follows.

10.20	Swinging freely. Poles removed.		
	Periodic time	1·181 secs.	(254 in 300)
11.45	Current on		
	Periodic time	0·560	(428 in 240)
11.50	Current off		
	Periodic time	0·743	(403 in 300°)
12.0	– –	0·765	(392 – –)
Noon	– –	0·771	(389 – –)
13.0	– –	0·750	(400 – –)
14.0	– –	0·750	(400 – –)
15.10	– –	0·753	(398 – –)
16.0	– –	0·758	(396 – –)
17.0	– –	0·758	(396 – –)

Lalande battery.

8.15	0·133	P.D. cell no 5 across 0·94 ω	= 0·556
		EMF c = 0·591	= 0·636
	0·136	P.D. – – 8 – – 0·95	= 0·558
		EMF 0·582	= 0·638
17.30	0·094	P.D. cell no 5 – 0·94 ω	= 0·580
		EMF c = 0·617	= 0·638
	0·093	P.D. – – 8 – – 0·95	= 0·598
		EMF c = ~~0·587~~ 0·603	= 0·650

Charged the Torpedo cable at 16 o'clock for 10 mins: with reversal from 1340 volts, the outer conductor being put to one pole and the inner conductor earth being put to the other. Also left 1200 volts on till 17.40 o'clock.

39) Wednesday 29th February.

Set up a new series of Lalande cells as follows:—

No 9	[redacted]	20%	Toppan potash (1lb to 2 lbs water)
" 10	[redacted]	30%	do do.
" 11	[redacted]	20%	Rennie potash
" 12	H	30%	do. do.
" 13	H	50%	do. do.

Turned under cells.

13.30 Following observations were taken before cells did any work.

No 9	EMF	0.890	PD across 30	0.654	I.R.	0.12	C 1962
" 10	"	0.923	" " "	0.663	"	0.131	1989
" 11	"	0.876	" " "	0.684	"	0.093	2062
" 12	"	0.968	" " "	0.738	"	0.104	2114
" 13	"	0.986	" " "	0.826	"	0.065	2071

Cells set to work on 1/2 of an ohm brass wire.

14.20							
No 9	P.D.	0.616	EMF	0.746	I.R. 0.070	C	1.848
" 10	"	0.610		766	0.085		1.830
" 11	"	0.624		750	0.056		1.872
" 12	"	0.618		768	0.065		1.854
" 13	"	0.592		766	0.076		1.776
17.30.							
No 9	"	0.614	"	0.720	I.R. 0.057	C	1.842
" 10	"	0.590	"	0.732	0.080		1.770
" 11	"	0.622	"	0.736	0.052		1.866
" 12	"	0.622	"	0.736	0.052		1.866
" 13	"	0.597	"	0.728	0.072		1.791
" 5	"	(0.34) 0.600	"	0.650	0.050		0.638
" 8	"	(0.35) 0.597	"	0.637	0.063		0.628

First 10 Agbl ale compared well the mean being 1.1246 volt the highest 1.128
lowest 1.120

Aaron meter started at 13.30 for constant with 4 amps but current not constant.

8.30 cell no 5		0.596	0.940	0.646	C 0.638	I.R.	
" " 8		0.590	0.950	0.640	0.621		0.050

Following results were obtained with the magnetic pyro induction apparatus, using a length of brass wire as the working substance.

Energy absorbed

Time secs	Number Torsion Spring	Current deduced	P.D. at cond'r wire	Product of E and C. Work done in wire	Product of E and C. ECXT
	A	C.G.S.U.	volts C.G.S.U.	ergs per sec.	ergs consumed
27	—	—	6.64X10	—	—
37	111	9.777X10⁻²	5.132X10⁷	1.896X10⁹	
25	119	1.012	5.74X10⁷	5.806X10⁷	1.452X10⁹

Energy delivered.

2X Throw angle Tan	Throw of needle from 2X1.25	Q/t passing thro' galv.	E. deduced on electrometer	E.Q	Efficiency
divs		C.G.S.U.	C.G.S.U.	ergs	
13	2.3	3.198X10⁻²	7X10⁷	2.2X10⁷	2.09X10⁷ / 1.452X10⁹
12	"	2.931X10⁻²	"	2.05X10⁷	
12.2	"	2.98X10⁻²	"	2.09X10⁷	1.44X10⁻⁸

The EMF of discharge was estimated by taking half the observed swing of the electrometer needle which was 1 div or $\frac{1.125}{8.2} = 0.14$ volt ÷ 2 = 0.07 volts. The quantity discharged was compared with that obtained from ½ f charged up to 1 Agbl (11.25 volts). The product of the quantity and e.m.f. so estimated was taken as the work performed. The work absorbed was taken as the product of the current & P.D. on the wire by the time required to stretch the wire to attraction point. Twice the throw of the discharge galv. was accepted.

240) Pyro Cell results
1 Volt (1.124 volts) 58.25 / 41.8 } 16.45
Const: .06932

Sodium sulphate
Platinum + carbon 55 / 45 } 10 = 0.6832 volts
Carbon + element
Boiling over very rapidly

Sodium phosphate
Platinum + carbon 55 / 45 } 10 = 0.683 volts
Carbon + element
Salt not entirely fused.

Sodium phosphate with 10% Boracic acid
Platinum + Fuller carbon 53 / 47 } 6 = 4099 volts
Carbon + element

Sodium phosphate with 10% Boracic acid
Silver + carbon
Carbon + element 54 } 8 = 0.546 volts
I. R. 20ω or under but Pot: fell after
test to 51 apparently) unable support current

Strontium sulphate
Platinum + arc carbon
Carbon + element 55 / 45 } 10 0.683 volts

Strontium sulphate with 10% boracic acid
Platinum + arc carbon 55.5 / 44.5 } 11 = 0.75 volts
Carbon + element
I. R. 14300ω Pot rose to 56.8

Strontium sulphate with 40% boracic acid
Platinum + carbon 59 / 41.2 } 17.8 = 1.216 volts
Carbon + element
I. R. 3400ω

24% Strontium sulphate, 66% Boracic acid
10% powdered glass
Platinum + carbon 55 / 45 } 10 = 0.683 volts.
3400ω

41)

Thursday 1st March

Clock fast on watch at noon 7.88 secs: showed yesterday.

Lalande cells as follow.					
				I.R.	C.
8.30	No 9.		0.606	0.693	0.038	1.818
	" 10		0.610	0.700	0.043	1.830
	" 11		0.613	0.696	0.031	1.839
	" 12		0.615	0.700	0.040	1.845
	" 13		0.612	0.726	0.052	1.836
	" 5	(0.94)	0.598	0.620	0.066	0.626
	" 8	(0.95)	0.595	0.638	0.064	0.629
17.30	No 9		0.597	0.656	0.034	1.791
	" 10		0.603	0.666	0.035	1.809
	" 11		0.604	0.660	0.039	1.812
	" 12		0.607	0.683	0.041	1.821
	" 13		0.610	0.716	0.057	1.830
	" 5		0.592	0.636	0.069	0.629
	" 8		0.597	0.634	0.059	0.625

Aaron meter readings. 100 represent 8.35 X 4.28 = 35.692 amp. hr

8.40	Current 4.27	Rdg.	0.9440	
13.55	" 4.28	"	0.9500	Const: multiplier
17.00	"	"	0.9540	" ∴ 0.356.

Result with Ballistic Galvo. proportional (continuing) measurements with magnetic induction

$\lambda = \frac{1}{20} \log \frac{474.5}{135}$

Set no 1.

1st double elongation . 484.5 } $\lambda =$ $1+\frac{1}{2} =$
21st " " 135.0
10 complete swings T = 346 secs. = 34.6

Set no 2

1st double elongation . 458.75 } $\lambda =$ $1+\frac{1}{2} =$
21st " " 132
10 complete vibs in 340 secs = 34.0

Set no 3

1st double elongation 448.5 } $\lambda =$ $1+\frac{1}{2}$
21st " 128.5
10 complete vibs in 345 secs = 34.5

1 blank standard cell discharging ½t at 20.8°C discharge = 100 divs mean. ±

Table showing behaviour of Halande cells.

Date	Cell No	Liquid	% of H₂SO₄ by weight	% of H₂SO₄ in solution by weight	Res. in cct.	Time of obs.	Page of hand.	Hour from start	EMF	S.R.	C.
21.2.88	7	Sulph	20%		0.95 + 28	Noon	28	0	0.918	0.066w	1.3914
						17	30	5	0.908	0.075	1.30
22.2.						9.30	30	21½	0.668	0.044	1.26
						16.30	31	28½	0.660	0.032	1.28
23.2.						9.0	32	45	0.666	0.049	1.23
24.2						10.30	33	70½	0.652	0.051	1.19
						17.45	33	77½	0.646	0.062	1.23
25.2						9.0	35	93	0.632	0.055	1.21
						15.0	35	100	0.596	0.079	1.18
					Removed (found to be leaking).						
21.2.88	8	Sulph	33⅓%	0.95 + 28 w		Noon	28	0	0.970	0.592	1.39
						17	30	5	0.742	0.072	1.36
22.2.88						9.30	30	21½	0.660	0.060	1.26
						16.30	31	28½	0.696	0.068	1.28
23.2.88						9.0	32	45	0.648	0.061	1.23
24.2.88						10.30	33	70½	0.586	0.060	1.19
						17.45	33	77½	0.664	0.058	1.23
25.2.						9.0	35	93	0.642	0.063	1.21
						15.0	35	100	0.620	0.069	1.18
27.2.						8.30	36	140½	0.632	0.10	0.602
						17.0	36	149	0.644	0.076	0.627
28.2						8.15	38	164½	0.638	0.136	0.587
						17.30	38	173½	0.650	0.088	0.609
29.2.						8.30	39	188½	0.640	0.080	0.621
						17.30	39	197½	0.637	0.063	0.628
1.3.						8.30	41	212½	0.638	0.064	0.629
						17.30	41	221½	0.634	0.059	0.628

By Pyro cell results

Agfa cell (1.124) = $\left.\begin{matrix}58.2\\41.8\end{matrix}\right\}$ 16.4 1 div = 0.0685 volt.

Sulphate of strontium with 20% glacial phosphoric

Platinum + ½" arc carbon } 62.3 / 38.3 } 24 = 1.6424 volts.
Carbon + element

S.R. 13.5 w carbon immersed ½" ½" dip diminishing to point ft. 1" immersed 3/8" wide at top 5" bottom

Sulphate of strontium with 25% glacial phosphoric acid

Platinum + ½" arc. carbon } 58.2 / 41.2 } 17 = 1.16 volts
Carbon + element

S.R. 7w. element immersed 1½" 3/4" separation.

70% Sulphate of strontium with 20% glacial Ph acid 10% glac

Platinum + carbon } 58 / 42 } 16
Carbon + element

S.R. 10w.

80% Sulphate of strontium 15% Phos. acid 5% glac product

Platinum + carbon } 57.5 / 42.5 } 15
Carbon + element

S.R. 14w.

Friday 2nd March.

Laland battery results as follow

8.30.	P.D.	EMF	C.	I.R.
No 9.	0.586	0.634	1.758	0.027
" 10	0.598	0.657	1.794	0.033
" 11	0.595	0.647	1.785	0.029
" 12	0.603	0.677	1.809	0.041
" 13	0.611	0.708	1.833.	0.052
" 5	0.603	0.646	0.641	0.067
" 8	0.595	0.630	0.626	0.056

Clock 1.38 sec fast on watch or 2.23 fast on which stand up

Aaron meter trial.

9.18	12.2 amps:	09 45	
12.0	12.2 "	09 44	
17.20	12.2 "	09 10	

$8^{v}.15 \times 12.2 = 99.43$
$2.82 \times 12.2 = 32.404$
$99.5 - 32.404 = 0.2977$
$265 \div 99.43 = 0.2665$
$46 \div 15.024 = 0.2552$
$8.33 \times 12.2 = 65.026$

Laland cells

17.30	P.D.	EMF	C.	I.R.
No 9	0.579	0.634	1.737	0.031
" 10	0.590	0.658	1.770	0.039
" 11	0.587	0.640	1.761	0.031
" 12	0.594	0.670	1.782	0.042
" 13	0.594	0.706	1.782	0.062
" 5	0.596	0.643	0.627	0.014
" 8	0.588	0.620	0.625	0.067

Pipe carbon cell. 1. hydl ≡ 16.4 Carb 0.0665

Strontium sulphate with 20% Sodium sulphate

Platinum + carbon } 60 } 20 = 1.370 volt
Carbon + element } 40

I.R. 40w.

Strontium sulphate 60% Sulphate Sodium 30% 10% Pb. acc

Platinum + C. } 58.5
C + element } 41.5 } 17 = 1.165 v.

I.R. 4w Crust formed when broken EMF was 6.59

Strontium sulphate 50% Sulphate Sodium 37.5 Chloride Pb: 12.5

Platinum + carbon } 55
C + element } 45 } 10 = 0.685 volts

Behaviour of Laland cells.

Cell No.	Nature of Kind.	% Kind of Pb. solution	Pb. in cell.	Date of Obs:	Days of Ind.	Time of Obs:	Hours from start	EMF	I.R.	C.
9	Tiffen	20%	1½	29.2.88	39	13.30	0	0.890	0.120	1.362
						14.20	¾	0.746	0.070	1.848
						17.30	4	0.720	0.057	1.842
				1.3.	41	8.30	19	0.693	0.038	1.818
						17.30	28	0.658	0.032	1.791
				2.3.	43	8.30	43	0.634	0.027	1.758
						17.30	52	0.634	0.031	1.737
				3.3.	45	8.30	67	0.626	0.030	1.710
						18.30	76	0.626	0.033	1.710
				5.3.	46	8.30	115	0.587	0.1444	1.188
10	Tiffen	30%	1½	29.2.88	39	13.30	0	0.923	0.131	1.989
						14.20	¾	0.766	0.085	1.830
						17.30	4	0.732	0.080	1.770
				1.3.88	41	8.30	19	0.702	0.063	1.890
						17.30	28	0.666	0.035	1.809
				2.3.88	43	8.30	43	0.657	0.033	1.792
						17.30	52	0.658	0.029	1.770
				3.3.88	45	8.30	67	0.650	0.026	1.758
						16.30	76	0.648	0.026	1.758
				5.3.88	46	8.30	115	0.596	0.050	1.515
				6.3.88	46	8.30	139	0.618	0.039	1.578
					47	11.0	141½	0.611	0.036	1.590
						12.0	142½	0.618	0.038	1.586

Cell No.	Nature of Rdg	% of Rdg	R.	Page of Record	Date	Time of Obs:	Hours from Start	EMF	I.R.	C.		
11	Cairo	20%	5Ω	39	29.2.88	13.30	0	0.876	0.093	2.062		
						14.20	5/6	0.750	0.050	1.874		
						17.30	4	0.726	0.022	1.866		
				41	1.3.88	8.30.	19	0.678	0.031	1.839		
						17.30	28	0.660	0.031	1.812		
				43	2.3.88	8.30	43	0.647	0.029	1.785		
						17.30	52	0.640	0.031	1.761		
				45	3.3.	8.30	67	0.638	0.033	1.748		
						16.30	75	0.652	0.039	1.752		
				46	5.3.88	8.30	115	0.592	0.050	1.578		
				"	6.3	9.30	139	0.594	0.050	1.578		
				47	" "	11.0	141½	0.594	0.050	1.578		
						12.0	142½	0.598	0.052	1.578		
12	Cairo	30%	5Ω	39	29.2.88	13.30	0	0.868	0.104	2.214		
						14.20	5/6	0.768	0.065	1.874		
						17.30	4	0.736	0.052	1.866		
				41	1.3.88	8.30	19	0.720	0.050	1.848		
						17.30	28	0.683	0.041	1.821		
				43	2.3.	8.30	43	0.677	0.041	1.809		
						17.30	52	0.670	0.042	1.782		
				45	3.3	8.30	67	0.645	0.032	1.770		
						16.30	75	0.676	0.049	1.770		
				46	5.3.	8.30	115	0.582	0.132	1.248		

Cell No	Nature of Rdg	% of Rdg	R.	Page of Record	Date	Time of Obs:	Hours from Start	EMF	I.R.	C.		
13	Cairo	50%	5Ω	39	29.2.88	13.30	0	0.986	0.065	2.478		
						14.20	5/6	0.766	0.076	1.776		
						17.30	4	0.729	0.072	1.791		
				41	1.3.	8.30	19	0.726	0.063	1.836		
						17.30	28	0.716	0.057	1.830.		
				43	2.3.	8.30	43	0.708	0.062	1.833.		
						17.30	52	0.706	0.062	1.782.		
				45	3.3.	8.30	67	0.688	0.072	1.698		
				"		16.30	75	0.696	0.099	1.688		
				46		8.30	115	0.830	34.-254	0.024		

45) 70% Strontium sulphate 20% Sodium sulphate
10% Phosph: acid

Pt + C
C + element 54·3 } 8·6 =
I.R. 80w

62·5% Strontium sulphate 25% Glac. phosph. acid
12·5% Sodium sulphate

Pt + C 57
C + element 43 } 14 = 0·96 volt
I.R. 60w unsatisfactory as C. broke.

Tried a series of pendulum experiment but hindered from several causes and results of no value.

Long magnet reading

8·0	(370 in 300)	P.T.	= 0·811
Noon	(370 - 300)	P.T.	= 0·811
17	(370 - 300)	P.T.	= 0·811

Calculated that on the basis of ½ sq. in: surfaces separated by 3/16" and 1·6 volts with 1 ohms I.R. 24 sq. feet of active surface at a separation of 1 in. would have a res: of 0·0025w the current 320 amperes. The external energy thus derived would amount to 0·34 h.p.

Saturday 3rd March

Salanda battery	8·30			
Cell no 9	0·570 EMF	0·620	B.R. 0·030	C 1·710
10	0·586	0·650	0·036	1·758
11	0·580	0·638	0·033	1·740
12	0·590	0·648	0·032	1·770
13	0·586	0·688	0·072	1·898
5	0·599	0·612	0·068	0·630
8	0·596	0·626	0·057	0·627
		16.30		
9	0·570	0·626	0·033	1·710
10	0·586	0·648	0·036	1·758
11	0·584	0·652	0·039	1·752
12	0·590	0·676	0·049	1·770
13	0·536	0·696	0·099	1·608
5	0·602	0·664		

Pyro cell result. 1 AgCl = 58·3 / 41·8 } 15·5 = 0·068 volt

70% Strontium sulphate A. 55
15% glacial phosphoric B. 45 } 10 = 0·68 volt
15% Sodium sulphate
Cu + Pt Quinon + element I.R. 20w.

80% Strontium sulphate A 290
10% Sodium sulphate B 400 } 19 = 1·292 volt
10% Glacial phosphoric I.R. 40w
Pt + C C + element

Monday 5th March

Lalande battery result

8·20

Cell no. 9	P.D. 0·396	EMF 0·567	C. 1·148	I.R. 0·144		
10	0·506	0·596	1·518	0·059		
11	0·509	0·592	1·527	0·055		
12	0·416	0·582	1·248	0·132		
13	0·008	0·830	0·024	34·20		
5	0·040	0·124				
8	0·528	0·600	~~[illegible]~~			

17.0 Tested Mr Sims' cable again after submitting it to 1200 volts

Insulation after charging for 60 secs.

60" Full potential 90·3

after 1 min 89·8

" 2 mins 89·4

" 3 " 88·9

" 4 " 88·6

" 5 " 88·2

Tested Voltmeter as follow.

			Potteck	
by potentiometer	113·4	by H. & B.	118	4·6+
		" A. & P.	117	3·6+
		" Gardew	120	6·6+

Tuesday 6th March.

Lalande cell. 8·20.

No 6.	P.D. 0·520	EMF 0·580				C
10	0·526	0·618	0·059	1·578		
11	0·516	0·594	0·050	1·548		

Test of voltmeters as follow:—

Mains connected to voltmeters in qty: and thro' 10000 ω of which 9900 ω separate & 100 ω in potech

	Potentometer Reading	P.D. across 100 ω	P.D. across 10,000 ω	Voltmeter No.	Reading	Error
1.	571	1·142	114·2	1	113·5	−0·7
				2	116	+1·8
				3	118·5	+4·3
				4	118	+3·8
				5	120	+5·8
2	566	1·132	113·2	1	113	−0·2
				2	115	+1·8
				3	118	+4·8
				4	117	+3·8
				5	119	+5·8
3	566	1·132	113·2	1	113	−0·2
				2	115	+1·8
				3	118	+4·8
				4	117	+3·8
				5	119	+5·8

In set 3 one ratio 100 was exchanged for the other as a check.

No 1 used H + B no 693

" 2 " H + B " 692

" 3 " Potteck double scale H + B.

" 4 " A + P. (spring).

" 5 " Gardew.

Tuesday 6th March contd.

4 new Lalande cells made up as follows

No. 14.	20%	weight of caustic potash (real)
" 15	33⅓%	" " "
" 16	20%	" saponifier "
" 17	33⅓	" " "

11.0. Test of these immediately before setting to work

	P.D	EMF	I.R.	C.
10	530	614	0.053	1.570
11	516	594	0.050	1.548
14	626	979	0.186	1.878
15	662	997	0.169	1.886
16	620	712	0.050	1.860
17	621	814	0.050	1.863
8	528	578		
Noon 10	528	616	0.058	1.584
11	516	598	0.052	1.548
14	614	758	0.078	1.842
15	638	760	0.064	1.904
16	604	698	0.051	1.812
17	586	716	0.073	1.758

15.0 Discovered that cell no 15 was leaking. Exchanged in his outer cell, and made up a little more solution to replace what had been lost.

17.0 8	0.530	582		
10	0.525	614	0.057	1.575
11	0.496	572	0.050	1.488
14	0.616	680	0.034	1.848
15	632	700	0.036	1.896
16	612	684	0.039	1.836
17	582	654	0.041	1.746

1. Agbl = 58.15 / 41.75 } 16.4 Constant 0.068

50% Wolframic acid
50% Sulphate of potassium.
Element immersed 1½" 3/8" apart
Pt + C. Zn + element
Chemical in molten state

A 57.5 / B 44 } 13.5 = 0.918 volt
I.R. 4w using 4 6w.

60% ~~[illegible]~~ Sulphate of potassium
40% ~~[illegible]~~ Wolframic acid
~~20% Borax~~ + arc carbon

A 61 / B 39 } 22 = 1.496 volts
I.R. 6w.

C + element
Chemical in pasty condition.
Platinum dissolved.

48% Sulphate of potassium
32% Wolframic acid
20% Borax

51.8 / 48.3 } 0.218 volt
I.R. less than 1w including lines

Plat: + C. C + element
Chemical in ~~pasty~~ molten condition
Platinum dissolved.

9% Borax
45.5% Wolframic acid
45.5% Sulphate of potassium

52 / 48 } 4 = 0.272 volt
I.R. 4w

Silver + carbon C + element

Behaviour of Lalande cells.

Cell No.	Nature of KHO	% in solution by weight	R. in cct	page of record	Date	Time of obs.	Hours for start	EMF Volt	I.R. ω	C. amp
14	Neut	20%	1/30	47	6. 3. 88	11.0	0	0.979	0.184	1.676
						Noon	1	0.758	0.078	1.842
				49	7. 3. 88	17	6	0.680	0.034	1.848
						8	21	0.670	0.042	1.788
				50	8. 3. 88	17.30	30½	0.625	0.022	1.764
						8.30	45½	0.622	0.022	1.748
				50	9. 3.	17.30	54½	0.622	0.028	1.719
						8.30	69½	0.240	—	0
						Exhausted, and removed.				
18	neut	50%	1/30	50	8. 3. 88	12.0	0	0.666	0.029	1.836
						17.30	3½	0.684	0.033	1.670
					9. 3.	8.30	19½	0.670	0.134	1.631
						16	28	0.578	0.150	1.170
				51	10. 3	8.30	52½	0.600	0.160	1.212
						16.0	50	0.560	0.155	1.116
					12. 3	17.0	91	0.516	0.176	1.011
						18.0	100	0.496	0.119	1.025
					13. 3	10.0	116	0.430	0.146	0.909
15	neut	33⅓%	1/30	47	6. 3. 88	11.0	0	0.997	0.169	1.986
						Noon	1	0.760	0.064	1.914
				49	7. 3. 88	17	6	0.700	0.036	1.896
						8	21	0.680	0.030	1.875
				50	8. 3. 88	17.30	30½	0.648	0.020	1.875
						8.30	45½	0.644	0.018	1.830
					9. 3.	17.30	54½	0.636	0.016	1.821
						8.30	69½	0.626	0.024	1.782
				51	10. 3	18.0	79	0.557	0.021	1.572
						8.30	93½	0.562	0.021	1.584
						16.0	101	0.542	0.229	1.494
				51	12. 3	9.0	142	0.296	0.060	0.759

Cell No.	Nature of KHO	% in solution by weight	R. in cct	page of record	Date	Time of obs.	Hours for start	E.M.F.	I.R.	C.
16	Superfin	20%	1/30	47	6. 3. 88	11	0	0.712	0.050	1.860
						12	1	0.698	0.051	1.812
				49	7. 3. 88	17	6	0.684	0.039	1.836
						8	21	0.656	0.035	1.779
				50	8. 3.	17.30	30½	0.646	0.032	1.764
						8.30	45½	0.620	0.028	1.716
					9. 3.	17.30	54½	0.626	0.033	1.710
						8.30	69½	0.614	0.036	1.682
				51	10. 3.	18.0	79	0.574	0.044	1.440
						8.30	93½	0.502	0.040	0.684
						16.0		0		
						Exhausted.				
17	Superfin	33⅓%	1/30	47	6. 3. 88	11	0	0.814	0.050	1.863
						12	1	0.716	0.073	1.754
				49	7. 3.	17	6	0.654	0.041	1.746
						8	21	0.610	0.022	1.668
				50	8. 3.	17.30	30½	0.628	0.041	1.674
						8.30	45½	0.614	0.046	1.620
					9. 3.	17.30	54½	0.594	0.035	1.608
						8.30	69½	0.578	0.045	1.530
				51	10. 3	18.0	79	0.504	0.056	1.296
						8.30	93½	0.502	0.061	1.272
						16.0	101	0.422	0.066	1.082
					12. 3	9.0	142	0.168	0.166	0.336

Wednesday 7th March

Lalande battery.

8·30

8	0·485	0·522		
10	0·510	0·592	0·053	1·530
11	0	·100	—	
14	0·596	0·670	0·042	1·788
15	0·625	0·682	0·030	1·875
16	0·593	0·656	0·035	1·779
17	0·556	0·610	0·032	1·668

Suspended a piece of solder weighing nearly 14·5g: in all ~ 15.

17.30	8	0·474	0·524		
	10	0·508	0·568	0·039	1·524
	14	0·588	0·628	0·022	1·764
	15	0·625	0·678	0·029	1·875
	16	0·588	0·646	0·032	1·764
	17	0·558	0·628	0·041	1·674

1 Agl cell. 58·25 / 41·85 } 16·4 Const: 0·068

~~45~~ 47·5%	Sulphate of Potassium	55·5
47·5%	Sulphamic acid	46·5 } = 0·748 volt
5%	Boracic acid	S.R. 3·5ω

Silver + carbon

Carbon + element.

53·3%	Sulphate of Potassium
46·7%	Soda.

Pt + arc carbon

Carbon + element

Before fluid melted reached 59·8 + abt 10ω as fluid melted this decreased 6 degs

Received from Mr Tait a letter written by Mr Waldo referring to a coil of uncovered German silver wire (also received) stating that this wire had a high specific and low temp. coeff. resistance.

The wire was approx. 0·032" in diam = 0·08132 cm

Strung 2812 cms of it up and down a wooden board and measured its res: = 22·1ω @ 19°C. Its area being 0·02077 sq cms ÷ 4 = 0·005189 = the res: of 1 cm. would be $\frac{22.1}{2812} \times \frac{0.02077}{5} = 1.632 \times 10^{-4}$

∴ in abs: measure the res: is $1.632 \times 10^{-4} \times \frac{1632000 \div 4}{48800}$

The res: was measured again when the board was outside the house in fair at temp: 2°C. and found to be 22·04ω. = 0·06ω for a rise of 17° = 0·00353ω per °C. = 0·016% per °C.

Repeated test in afternoon as follows.

Coiled 98 feet (2987 cms) on a wooden reel and took its res: at three temps: as follow.

At	−1°C	=	23·21ω
@	19°C	=	23·31ω
@	33°C	=	23·46ω

} quite proportional

Diam 0·032" = 0·08128 = 0·040640 r. = 0·005189 sq. cms.

$\frac{23.21}{2987} \times \frac{0.005189}{1} = \frac{2.321 \times 5.189 \times 10^{-6}}{2.987} = 4.032 \times 10^{-6}$ specs. res: 22·7 from eqn above

In 54° — 0·27ω are gained in 1° 0·005ω are gained

0·005 in 23·2 = 0·0215%.

Coiled 29 feet of another sample on the same bobbin and took its res: at two temps

@	−1°C	=	17·28ω
@	19°C	=	17·365

In 20° — 0·085ω are gained

1° — 0·00425ω by 17·3ω

— 0·02456%

Diam 0·0225" = 0·05715 cms = 0·02858 cms r = 0·00257 sq. cms: area

$\frac{17.28 \times 0.00257}{893.9} = \frac{1.728 \times 2.57 \times 10^{-3}}{0.8939} = 5.024 \times 10^{-6}$ = Chr. of 50240 50182 Ohm Cir.

5D

Thursday 8th March

Lalande cells

8.20.

				C.
No 8	0.418	0.470		
- 10	0.484	0.580	0.041	1.452
- 14	0.580	0.622	0.022	1.740
- 15	0.610	0.644	0.018	1.830
- 16	0.572	0.620	0.028	1.716
- 17	0.540	0.614	0.046	1.620

A current of approximately 2 amperes was kept flowing for several minutes through a spiral of the german silver wire tested yesterday 25 feet long, its res: at the temp: of the room being 0.045 ω at the increased temp: it became 6.065 ω A gain of 0.02 ω in 6.02 or 0.332 % corresponding to an increase of nearly 16° rise of temp:

13.50 A Lalande cell was set to work thro' 5ωs of an ohm with 50% real caustic potash. Its E.M.F before setting to work was 0.666

P.D.			0.612:	1.836

17.30.

No. 8	0.404	0.462		
10	0.481	0.574	0.064	1.443
14	0.573	0.622	0.025	1.719
15	0.607	0.686	0.016	1.821
16	0.570	0.626	0.033	1.710
17	0.536	0.594	0.035	1.608
18	0.490	0.684	0.133	1.470

Friday 9th March

Lalande cell.

8.30

No 8.	0.404	0.456		
10	0.433	0.540	0.083	1.299
14	0	0.240	Exhausted.	—
15	0.594	0.636	0.024	1.782
16	0.554	0.614	0.036	1.662
17	0.510	0.578	0.045	1.530
18	0.477	0.670	0.134	1.431

18.0

No 8	0.436	—		
- 10	0.274	0.362	0.106 ω	0.822
- 15	0.524	0.557	0.021 ω	1.572
- 16	0.480	0.544	0.044	1.440
- 17	0.432	0.504	0.056	1.296
- 18	0.390	0.576	0.159	1.170

51)

Saturday 10th March.

8.20 Lalande cells

No 8	0.432	0.468		~~1.246~~
- 10	0.144	0.210	0.150	0.432
- 15	0.528	0.562	0.021	1.584
- 16	0.228	0.502	0.400	0.684
- 17	0.424	0.502	0.061	1.272
- 18	0.404	0.600	0.160	1.212

16.10

No 8	0.382	0.424		~~1.144~~
- 10	0.084	0.136	0.206	0.264
- 15	0.498	0.542	0.029	1.494
- 16	0	0	0	0
- 17	0.361	0.432	0.066	1.083
- 18	0.382	0.560	0.155	1.146

Removed nos 10 and 16

Pyro Carbon cell 1 Agbl. 58 / 42.1 } 15.9 Grat 0.070

33 % Boracic acid
67 % Sulphate of iron } 51 / 49 } 2 = 0.140 volt
Pt + C.
C + element

50 % Boracic acid
50 % Sulphate of iron } 47 falling to 49.5 unable to get higher reading
Iron + C.
C + element

Monday 12th March.

Lalande cells.

9.0.

No. 8.	0	0		
- 15	0.250	0.296	0.060	0.750
- 17	0.112	0.168	0.166	0.336
- 18	0.338	0.516	0.176	0.014

Removed nos 8, 15 + 17.

Pyro carbon cell 1 Agbl = 1.124 + 16.4 Grat = 0.068

60 % Potassium sulphate
40 % Natrium wolframate } 56.3 decreasing by 5.6 = 0.856 volt
Pt + C. J.R. att 44
C + element chemical not mixed

80 % Potassium sulphate
20 % Natrium wolframate } 55.5 J.R. 30 decreasing to 51.1 J.R. 13
Pt + C.
C + element

55 % Potassium sulphate
33 % Natrium wolframate
12 % glacial phosphoric } 56 / 22.35 = 0.38 volt.
Pt + C.
C + element

Lalande cells.

No. 18	0.342	0.496	0.119	1.036

18 o'clock

Set up Edelmann wall electrometer experimentally and obtained a deflection of about 6 cms: per volt at a range of some 5 metres.

Obtained the approx: constant of the Obach Galvo: carefully adjusted as follows:—

1 Fuller cell = 1.590 volts measured gave thro' the long coil and its own internal res: a deflection of 0.23 ± on long scale.

Assuming the res: of the circuit at 2230ω the current would be $\frac{1.59}{2230}$ = .000713 amps.

If 0.23 be produced by .000713 amps
1 will be — $\frac{.000713}{0.23}$ = .0031
x . . . . $\frac{0.0031}{}$ x amperes.

Tuesday 13th March

10.0 Lalande cell

No. 18	0.303	0.430	0.440ω	0.909

Took Constant of tan: galvo: as follows:—
P.D. at mains measured by A.+P. voltmeter. Current from mains passed thro' two res: boxes and both large ring and Obach Galvo: also through Mercury galvo.

P.D. 126.90 — 3.8 = 117.2

Obach Reading)	0.148 ±	or 8°.25' + / 8°.20' —
Ring tangent		7°.30' mean.
Mercury) galvo.		- 0.8 + — 0.1 = 0.7 +
Res: 116.7ω.		

Current was $\frac{117.2}{116.7}$ = 1.004 amps.

On the Obach galvo: ring vertical 0.148 represent 1.004 amp
1 = $\frac{1.004}{.148}$ = 6.778
x = 6.778 x amp

On the Ring galvo. — tan 7°.30' represent 1.004 amp:
" — 45° — $\frac{1.004}{.1317}$ = 7.62
tan x — 7.62 × x amps

On the Mercury galvo 0.7 represent 1.004 amp.
1.0 — 1.429 "
x — 1.429 x —

Tested the ½+ Schuchardt standard against the new Elliott Std as follows:— Bismuth method

Silty 0.54 : New 0.54 sum of min & pp :: 1617ω : 2000ω = 0.40454
:: 808ω : 1000ω = 0.404
: new 0.54 single :: 808.5ω : 1000 = 0.40425
:: 1611 : 2000 = 0.40275
: 0.4 + 0.05 bifil in mean = 2000 : 2000 = 0.40475
1000 : 1000 = 0.40475

2500
Mean. 0.40417

53)

Wednesday 14th March.

Lalande cell no 18.

9.0. P.D. 0.1544 EMF 0.1844 I.R. 0.0061 C. 0.462 — Cell removed.

Took constant of small Siemens Din-tom galv: as follows:—

0.976 volt thro' 6.5ω gives 145° on large coil
0.976 - 309ω + 119 = 428ω gives 145° on thin wire coil
∴ 0.0023 amp. produces 1 deflⁿ on thin wire
0.150 - - 1 - - thick

And currents producing deflection θ are 0.0023 tan θ respectively 0.150 tan θ

Any EMF in cct with the thin wire coil gives $\frac{E}{120+r} = 0.0023 \tan\theta_1$

Any EMF in cct. with the coarse wire coil give $\frac{E}{r} = 0.150 \tan\theta_2$

∴ when Res: is low $E = 0.276 \tan\theta_1$
and $r = \frac{0.276 \tan\theta_1}{0.150 \tan\theta_2} = 1.84 \frac{\tan\theta_1}{\tan\theta_2}$ ohm.

Constant of Obach thin wire coil as follows

1.033 volts thro: 2230ω gives 0.155
1.033 - 2380ω 0.1145 + 0.0447 ow Instrument

∴ current of $\frac{1.033}{2230}$ or 0.0004463 produces 0.155

∴ $\frac{0.0004463}{.155} = 0.003$ - 1

a

Current of $\frac{1.033}{2380}$ or 0.0004434 produces 0.1145

∴ $\frac{0.0004434}{.1145} = 0.003$ produces 1

∴ A tangent deflection x = 0.003 x amps
and for a current of C amperes a reading of $\frac{C}{.003}$ must be obtained or for M milliamperes $\frac{M}{3}$ must be read.

The Ducretet Galvo coincidences in the ratio of $\frac{0.0447}{0.0434}$ or 1.032

To obtain a current C require a reading of 1.032 C. while a reading + means a current of 0.928 +

Pyro carbon cell. Res: of leads to Cleto 1.8ω
1 Agbl. = 16.4. Constant 0.068

25% acid. Phosphc. Wolframic. } 53.3 max: deflⁿ
75% Sulphate of potash. } = 0.45 volt.
Pt and C. Res: less than 1ω.
C. + element Pt formed alloy + decomposed.

Same mixture
Cu and C. } 48
C neg: element } = 0.27 volt
Res: less than 1ω
Cu formed alloy and decomposed.

Same mixture
Fe and C. } 56 at first Res. 2ω
C. + element } but gradually fell to 50.5
Fe formed alloy and decomposed.

75% Sulphate of soda } 54 = 0.54 volt.
25% Boracic acid } Int. 2 to 3ω lead wire: 1
Deflⁿ increased with heat
Pt and C.
C + element.

60% Sulphate of soda } 59.5 = 1.312 volt
20% Boracic acid } I.R. 2.5ω
20% Sulphate of strontium. } Deflⁿ fell rapidly with heat
Pt and C. but I.R. very low.
C. + element

25% Sulphate of strontium } very low EMF
75% - - soda } Not observed
Pt and C.
C. + element

Thursday 15th March.

Pyro carbon cell. 1 Agbl. 16.4. dis 0.068 volt.

75% Sulphate of Magnesia } 55.5 } 11 = 0.7458 volt.
25% Boracic acid. } 44.5 } J.R. very high.
Pt and C.
C. + element. unable to melt substances

Iron and C. very low indications

50% Sulphate of Magnesia }
50% Boracic acid }
Cu and C.
C. + element. indications very low.

Iron and C. indications very low
C + element

75% Boracic acid. } 54 } 8 = 0.5444
25% Sulphate of Magnesia } 46 }
Pt and C. J.R. very high.
C. + element.

75% Tin sulphate } 51.5 } 2.9 = 0.20
25% Phosphoric (glacial) } 48.6 }
Pt and C. J.R. 8Ω
C. + element. not melted.

Cu and C. very low indications
Fe " " (C. negelement) " "

25% Tin sulphate } 52 } 3.2 = 0.2 volt
75% Glacial phosphoric } 48.5 } J.R. under 1Ω.
Pt and C.
C. + element. Melt at low temp.

Cu and C. Carbon neg element
Fe. and C " " "
Nickel " " " " "
Silver " " " " "

60% Sulphate of Soda. } 54 } 7.5 = 0.51 volt.
20% Borax. } 46.5 } J.R. less than 1Ω.
20% " Phosphoric acid
Pt and C. C. + element Melted at low temp.

Cu and C. C. + element Small indications
Fe " " C neg. element " "
Nickel " " C " " "
Silver " " C + element 53 47 } 0.4 volt.

Checked indications of Emhiet Galvo and found them correct to 1 or 2%.

Friday 16th March.

1 AgBl 16·3 Pyro carbon cell. (0.069)

40% Sulphate of Strontium. } 52·5
60% Sulphate of Soda. } 48·5 } 4 = 0·276 volt.
4 to 2 R.
melting + pyro

Cu and C. C. + element.

Pt and C. } 53.6
C. + element } 46·5 } 7.1 = 0·49 volt.
4 to 3 R.

80% Sulphate of Soda } 51·2
20% Phosphoric acid. } 48·7 } 2.5 = 0·17 volt

Cu and C. C. neg: element

Pt and C C. + element 52 } 4 = 0·276
48 } I.R under 1 w

Iron and C. C. neg: element.

Silver and C C. + element 51 } 2 = 0·138
49 } I.R. 2 w

Nickel and C. C. neg: element.

80% Sulphate of Soda } 52·2
20% Borax } 47·7 } 4·5 = 0·308
I.R. 2 w

Pt and C C. + element

Cu and C. C. + element } 51·7
48·3 } 3.4 = 0·234
I.R. 3·1

Nickel and C. C neg
Iron and C " "
Chemical working
Poly in liquid state

25% Borax
75% Phosphate of Soda } very low readings

Pt and C. C. + element
Cu " " " "
Nickel " " " "
Iron " " " "
C neg element
} very low readings

50% Sulphate of Nickel
50% Borax.
Cu and C. C. neg.

Nickel - - C. neg.

25% Sulphate of Nickel
75% Borax
Pt and C. C. + very low readings

25% Sulphate of Nickel
75% Phosphoric acid.
Iron gave neg: result.

50% Sulphate of lead
50% Acid phosphoric. } low readings.
Pt and C C + element
Nickel - C. C - element.

Cu and C. C + element very low reading
Iron - element

Silver - - C + element - -

51)

Saturday) 17th March.

1 AgBC 16·3, Const. 0·069

75 % Glacial phosphoric
25 Bor SO₄
Copper and C.
C. neg. element — liquid state melted fuse.

Pt and C.
C. + element

Silver and C.
C. neg. element.

Nickel and C.
C. neg. element.

Iron and C.
C. neg. element.

25 % Sulphate of Copper
75 % Borax.
Copper and C
C. + element — chemical in glass condition

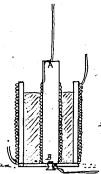
Pt. and C.
C. + element. } 53·5 / 46·3 } 0·50 volt S.R. 2.00

Nickel and C
C. + element.

Iron and C.
Carbon + element }

Silver and C
Carbon + element } 53 / 47 } 6 = 0·42 volt S.R. 2.00

Arranged an experimental apparatus as follows.



A piece of gas piping had 30 turns of copper wire wound on it and an inner core of iron had also 25 turns of the same wire wound on it. The intermediate space was filled up almost to the surface with paraffine wax. The pull of this arrangement which had, an iron base plate, was measured on a third solenoid of wire hung on a balance. When the outer solenoid and the suspended solenoid were excited the pull was 0·7 grammes, when the inner one was excited by the opposite polarity of the outer one the force was scarcely appreciable but when the outer and inner had both the same polarity the force was 1 gramme.

½ actual size

Monday 19th March.

1 to 11 16·35 Constant 0·069.

25% $CuSO_4$ } 52
75% H_2SO_4 } 48 } 4 = 0·276 volt
Cu and C. C. + element. Chemical in liquid condition. I.R. 7ω.

Iron and C. C. + element } 52·5 46·8 } 6·7 = 0·46 volt. I.R. 7ω.
increased to 54·0 46·5 } 7·5 = 0·51 volt I.R. 6ω

Platinum and C. C. + element } 59·2 41 } 19·2 = 1·256 volt I.R. 4 to 5ω.
Melting freely and remaining liquid only seemed to polarise slightly say 0·7 on doing work but appeared to rise steady at that

Ag and C. C + element } 53 47 } 6 = 0·411 volt I.R. 4ω

Nickel and C. } 52·5 47 } 5·5 = 0·38 volt I.R. 6ω

60% Sulphate of Potash
20% Acid phosphoric } 53·5 47·3 } 6·5 = 0·449 volt I.R. 4ω
20% Sulphate of manganese
Pt and C. C. ultimately +. Melted at low temp. dark scum rising on top

Cu and C. C. ultimately + } 50·5 49·7 } 0·8 = 0·051 volt I.R. 4ω

Nickel and C. C. neg element } 50·4 49·9 } 0·5 = 0·034

Iron and C. C. neg. element. } 46·2 53·9 } 7·7 = 0·533 volt I.R. 6ω

Silver and C. C. + element. } 53·3 46·5 } 7·4 = 0·511 volt. I.R. 4ω

50% Sulphate of Manganese } Melted freely but puffed.
50% Glacial phosphoric.
Pt and C. C. + element } 53·2 47·1 } 6·1 = 0·42 volt. I.R. 24 ω.

Cu and C. C. neg. element } slightly neg: results.

Silver and C. C. + element } slight results.

Iron and C. C. neg. element } small neg readings.

Nickel and C. C. neg: element } slight neg. result

50% Sulphate of Manganese } Baked under mist
50% Boracic acid.
Pt and C. C + element } small + readings.

Cu and C. C + element. } small + readings

Nickel and C. C. neg element } small − readings.

(60)

Tuesday 20th March.

18 Lalande cells were prepared as follows
9 with Lewis's Potash 10% 15% 20% 25% 30% 35% 40% 45%
9 - English do do - - - - - -
by weight in solution.

All the zincs, ~~were~~ grid, and outer cells were new and none of the outer cells leaked.

All were ready at 9.15.

Cell No.	Nature Potash	%	EMF	P.D.	t.	I.R.
19	Lewis	10	0.6450	0.5860	1.758	0.034
20	"	15	0.5170	0.4770	1.431	0.027
21	"	20	0.6910	0.6220	1.866	0.033
22	"	25	0.6760	0.6440	1.932	0.050
23	"	30	0.7270	0.6540	1.962	0.037
24	"	35	0.6920	0.6600	1.980	0.017
25	"	40	0.7870	0.6650	1.995	0.062
26	"	45	0.8350	0.6620	1.989	0.086
27	"	50	0.8730	0.6700	2.010	0.102
28	Lewis	10	0.6470	0.5840	1.752	0.036
29	"	15	0.7400	0.7200	2.160	0.010
30	"	20	0.7190	0.6380	2.014	0.042
31	"	25	0.7050	0.6380	1.914	0.035
32	"	30	0.7970	0.6390	1.944	0.093
33	"	35	0.8720	0.6250	1.875	0.130
34	"	40	0.7148	0.5540	1.662	0.115
35	"	45	0.949	0.700	2.100	0.119
36	"	50	0.776	0.576	1.728	0.086

Repeated test at 10.3 as follows.

Cell No.	P.D.	EMF	t.	I.R.
19	0.571	0.659	1.713	0.051
20	0.490	0.525	1.470	0.025
21	0.615	0.664	1.845	0.029
22	0.630	0.717	1.890	0.046
23	0.644	0.732	1.932	0.045
24	0.640	0.727	1.920	0.045
25	0.647	0.744	1.941	0.049
26	0.640	0.742	1.920	0.064
27	0.641	0.773	1.923	0.072
28	0.587	0.663	1.761	0.043
29	0.625	0.754	1.875	0.069
30	0.626	0.758	1.878	0.070
31	0.624	0.754	1.872	0.069
32	0.625	0.760	1.875	0.072
33	0.618	0.755	1.854	0.079
34	0.587	0.761	1.761	0.100
35	0.598	0.762	1.794	0.092
36	0.580	0.770	1.740	0.109
Now 19	0.573	0.637	1.719	0.037
20	0.514	0.552	1.542	0.025
21	0.613	0.662	1.839	0.026
22	0.627	0.703	1.881	0.025
23	0.636	0.730	1.917	0.047
24	0.640	0.736	1.920	0.050
25	0.645	0.744	1.935	0.051
26	0.640	0.740	1.935	0.051
27	0.641	0.744	1.923	0.050
28	0.596	0.657	1.788	0.034
29	0.625	0.752	1.875	0.067
30	0.626	0.745	1.878	0.064
31	0.620	0.738	1.890	0.057
32	0.631	0.739	1.893	0.057
33	0.628	0.713	1.884	0.045
34	0.605	0.767	1.815	0.089
35	0.614	0.764	1.812	0.084
36	0.598	0.764	1.794	0.092

61)

Cell No	Nature of KHO	% by weight solution	R in cell	Image of record	Date	Time of obs.	Hours for start	EMF volts	S.R. ohms	C amp.
19	Real	10%	1/50	60	20.3.88	9.30	0	0.645	0.032	1.758
						10.0	½	0.659	0.037	1.713
						Noon	2½	0.637	0.037	1.719
				67		17.30	8	0.642	0.038	1.728
				68	21.3.88	8.30	23	0.806	3.067	0.090
				69		17.32	32	0.236	2.692	0.078
					Cell exhausted and removed					17.30.23.3
20.	Real	15%	1/50	60	20.3.88	9.30	0	0.517	0.027	1.921
						10.0	½	0.525	0.028	1.870
						12	2½	0.552	0.025	1.942
				67		17.30	8	0.576	0.020	1.629
				68	21.3.	8.30	23	0.137	0.838	0.117
				69		17.30	32	0.096	2.333	0.038
					Cell exhausted and removed					17.30.23.3

Cell No	Nature of KHO	% by weight solution	R in cell	Image of record	Date	Time of obs.	Hours for start	EMF volts	S.R. ohms	C amp.
21	Real	20%	1/50	60	20.3.88	9.30	0	0.691	0.033	1.866
	"	"	"	"	"	10.0	½	0.644	0.029	1.905
						12.0	2½	0.662	0.025	1.929
				67		17.30	8	0.644	0.029	1.833
				68	21.3.	8.30	23	0.634	0.027	1.758
				69		17.30	32	0.603	0.025	1.683
				70	22.3.	8.30	47	0.145	4.747	0.030
					Cell exhausted, removed q.a. 22.3.88					
22	Real	25%	1/50	60	20.3.88	9.30	0	0.676	0.050	1.932
						10.0	½	0.717	0.0146	1.890
						12.0	2½	0.763	0.025	1.861
				67		17.30	8	0.696	0.031	1.884
				68	21.3.	8.30	23	0.656	0.029	1.809
				69		17.30	32	0.626	0.025	1.782
				70	22.3.	8.30	47	0.620	0.025	1.721
				72		17.30	56	0.610	0.018	1.737
				73	23.3.	8.30	71	0.140	3.555	0.036
					Cell removed. q.a. 23.3.88					

Bell No.	Nature of Metal	% by weight	% by weight	R cut	Page No.	Date	Time	Time now	EMF	J.R.	C
23	Kual	30%	½		60	20.3.88	9.30	0	0.727	0.037	1.962
							10.0	½	0.732	0.0145	1.932
							12.0	2½	0.730	0.047	1.917
					67	"	17.30	8	0.714	0.040	1.917
					68	21.3.	8.30	23	0.670	0.027	1.860
					69		17.30	32	0.640	0.026	1.836
					70	22.3.	8.30	47	0.636	0.021	1.794
					72		17.30	56	0.640	0.022	1.803
					73	23.3.	8.30	71	0.621	0.029	1.713
					77		17.0	79½	0.626	0.029	1.728
						24.3.	9.30	96	0.600	0.028	1.662
					78	24.3.	16.00	102½	0.611	0.027	1.698
					78	25.3.	9.30	120	0.052	—	0.0
						26.3.	8.30	143	0.016	—	0.
							Bell removed 8.30. 26.3.				
							Orchard cut		9.30	25.3.	
24	Kual	35%	½		60	20.3.88	9.30	0	0.692	0.017	1.980
							10.0	½	0.727	0.0145	1.920
							12.0	2½	0.731	0.050	1.920
					67		17.30	8	0.714	0.037	1.926
					68	21.3.	8.30	23	0.678	0.029	1.872
					69		17.30	32	0.666	0.025	1.857
					70	22.3.	8.30	47	0.644	0.022	1.812
					72		17.30	56	0.656	0.026	1.824
					73	23.3.	8.30	71	0.632	0.025	1.820
					77		17.0	79½	0.634	0.028	1.755
						24.3.	9.30	96	0.616	0.031	1.692
							16.0	102½	0.622	0.016	1.722
					78	25.3	9.30	120	0.594	0.030	1.644
						26.3	8.30	143	0.095	—	0
							Bell removed. 8.30. 26.3				

Bell No.	Nature of Metal	% by weight	% by weight	R cut	Page No.	Date	Time	Time now	EMF	J.R.	C
25	Kual	40	½		60	20.3.88	9.30	0	0.787	0.042	1.995
							10.0	½	0.744	0.0149	1.941
							12.0	2½	0.744	0.051	1.935
					67		17.30	8	0.724	0.036	1.962
					68	21.3.	8.30	23	0.694	0.032	1.899
					69		17.30	32	0.667	0.022	1.875
					70	22.3.	8.30	47	0.654	0.024	1.836
					72		17.30	56	0.648	0.017	1.848
					73	23.3.	8.30	71	0.622	0.026	1.761
					77		17.0	79½	0.637	0.025	1.779
						24.3	9.30	96	0.620	0.029	1.713
							16.0	102½	0.634	0.029	1.752
					78	25.3.	9.30	120	0.602	0.028	1.668
						26.3	8.30	143	0.090	0.052	1.530
					79	-	17.30	152	0.584	0.025	1.620
					81	27.3	9.30	168	0.328	0.056	0.828
							18.0	178½	0.080	0.067	0.060
							Bell removed.				
26	Kual	45	½		60	20.3.88	9.30	0	0.835	0.086	1.989
							10.0	½	0.764	0.064	1.920
							12.0	2½	0.740	0.050	1.920
					67		17.30	8	0.726	0.041	1.938
					68	21.3.	8.30	23	0.682	0.030	1.875
					69		17.30	32	0.680	0.031	1.886
					70	22.3.	8.30	47	0.664	0.031	1.846
					72		17.30	56	0.650	0.020	1.822
					73	23.3.	8.30	71	0.631	0.030	1.752
					77		17.0	79½	0.637	0.025	1.776
						24.3.	9.30	96	0.626	0.029	1.728
							17.0	102½	0.640	0.020	1.764
					78	25.3	9.30	120	~~0.600~~	~~0.032~~	1.680
						26.3	8.30	143	0.072	0.043	1.581
					79		17.30	152	0.600	0.034	1.635
					81	27.3.	9.30	168	0.586	0.034	1.596
							18.0	178½	0.552	0.037	1.491
					82	28.3.	9.0	191	0.278	0.100	0.180
							Bell removed.				

Cell No.	Nature of KHO_3	% by weight	R. in ect.	page.	Date	Time	Hours	EMF	I.R.	C.
27	Rock	50%	1/50	60	20.3.88	9.30	0	0.873	0.102	2.010
						10.0	½	0.779	0.072	1.923
						12.0	2½	0.744	0.050	1.923
				67		17.30	8	0.745	0.049	1.950
				68	21.3.	8.30	23	0.696	0.027	1.928
				69		17.30	32	0.696	0.035	1.899
				70	22.3.	8.30	47	0.620	0.023	1.854
				72		17.30	56	0.666	0.024	1.866
				73	23.3.	8.30	71	0.645	0.031	1.770
				77		17.0	79½	0.652	0.030	1.791
					24.3.	9.30	96	0.632	0.030	1.740
						16.0	102½	0.632	0.023	1.776
				78	25.3	9.30	120	0.622	0.034	1.695
					26.3	8.30	143	0.602	0.048	1.548
				79		17.30	152	0.618	0.040	1.656
				81	27.3	8.30	168	0.600	0.037	1.620
						18.0	178½	0.583	0.026	1.607
				82	28.3	9.0	191½	0.108	0.167	0.024
28	Lewis	10%	1/50	60	20.3.88	9.30	0	0.647	0.036	1.752
						10.0	½	0.663	0.043	1.761
						12.0	2½	0.657	0.0314	1.788
				67		17.30	8	0.639	0.030	1.752
				68	21.3.	8.30	23	0.627	0.027	1.632
				69		17.30	32	0.628	0.023	1.671
				70	22.3.	8.30	47	0.616	0.047	1.339
				72		17.30	56	0.316	1.693	0.156
					Cell removed.					

Cell No.	Nature of KHO_3	% by weight	R. in ect.	page.	Date	Time	Hours	EMF	I.R.	C
29	Lewis	15%	1/50	60	20.3.88	9.30	0	0.740	0.010	2.160
						10.0	½	0.754	0.069	1.875
						12.0	2½	0.752	0.067	1.875
				67		17.30	8	0.703	0.039	1.887
				68	21.3.	8.30	23	0.691	0.0314	1.833
				69		17.30	32	0.682	0.033	1.809
				70	22.3.	8.30	47	0.605	0.011	1.755
				72		17.30	56	0.604	0.009	1.764
				73	23.3.	8.30	71	0.620	0.043	1.647
				77		17.0	79½	0.628	0.043	1.671
					24.3.	9.30	96	0.593	0.038	1.599
						16.0	102½	0.615	0.030	1.701
				78	25.3	9.30	120	0.178	—	0
					26.3.	8.30	143	0.020	—	0
					Cell removed 8.30. 26. 3.					
30	Lewis	20%	1/50	60	20.3.88	9.30	0	0.719	0.042	2.014
						10.0	½	0.758	0.070	1.878
						12.0	2½	0.745	0.064	1.878
				67		17.30	8	0.696	0.035	1.890
				68	21.3.	8.30	23	0.685	0.039	1.839
				69		17.30	32	0.674	0.037	1.815
				70	22.3.	8.30	47	0.652	0.036	1.744
				72		17.30	56	0.604	0.009	1.764
				73	23.3.	8.30	71	0.620	0.044	1.644
				77		17.0	79½	0.608	0.033	1.662
					24.3.	9.30	96	0.600	0.046	1.584
						16.0	102½	0.595	0.033	1.626
				78	25.3.	9.30	120	0.094	0.028	1.530
					26.3	8.30	143	0.168	0.091	0.396
					Cell removed nearly exhausted 8.30. 26. 3. 88					

Cell No.	Nature of Cell	% by weight	R in cent.	page.	Date	Time	Hours	EMF	I.R.	C.
31	Lewis	25%	1/30	60	20.3.88	9.30	0.	0.705	0.035	1.944
						10.0	½	0.754	0.069	1.872
						12.0	2½	0.738	0.057	1.890
				67		17.30	8	0.725	0.045	1.896
				68	21.3.	8.30	23	0.681	0.037	1.882
				69		17.30	32	0.661	0.031	1.812
				70	22.3	8.30	47	0.650	0.040	1.743
				72		17.30	56	0.604	0.010	1.761
				73	23.3.	8.30	71	0.614	0.040	1.644
				77		17.0	79½	0.621	0.042	1.665
					24.3.	9.30	96	0.597	0.047	1.572
						16.0	102½	0.602	0.042	1.608
				78	25.3.	9.30	120	0.604	0.066	1.512
					26.3.	9.30	143	0.110	0.018	
					Cell	removed		6.30.	26.	3.
32	Lewis	30%	1/30	60	20.3.88	9.30	0	0.797	0.053	1.944
						10.0	½	0.760	0.072	1.875
						12.0	2½	0.733	0.057	1.893
				67		17.30	8	0.721	0.045	1.905
				68	21.3.	8.30	23	0.699	0.044	1.847
				69		17.30	32	0.672	0.033	1.838
				70	22.3.	8.30	47	0.652	0.031	1.788
				72		17.30	56	0.655	0.029	1.806
				73	23.3.	8.30	71	0.625	0.035	1.698
				77		17.0	79½	0.628	0.031	1.722
					24.3.	9.30	96	0.627	0.047	1.650
						16.0	102½	0.619	0.033	1.692
				78	25.3	9.30	120	0.608	0.048	1.586
					26.3	8.30	143	0.591	0.025	1.493
				79		17.30	152	0.610	0.039	1.554
				81	27.3.	9.30	168	0.587	0.057	1.521
						18.0	176½	0.570	0.053	1.476
				82	28.3	9.0	192½	0.116	0.101	0.267
					Cell	removed				

Cell No.	Nature of Cell	% by weight	R in cent.	page.	Date	Time	Hours since start	EMF	I.R.	C.
33	Lewis	35%	1/30	60	20.3.88	9.30	0.	0.872	0.130	1.875
						10.0	½	0.765	0.079	1.854
						12.0	2½	0.713	0.025	1.884
				67		17.30	8	0.732	0.052	1.899
				68	21.3.	8.30	23	0.694	0.040	1.860
				69		17.30	32	0.694	0.043	1.842
				70	22.3.	8.30	47	0.638	0.044	1.770
				72		17.30	56	0.660	0.037	1.782
				73	23.3.	8.30	71	0.620	0.044	1.644
				77		17.0	79½	0.631	0.045	1.680
					24.3.	9.30	96	0.604	0.054	1.596
						16.0	102½	0.612	0.040	1.641
				78	25.3	9.30	120	0.582	0.043	1.548
					26.3	8.30	143	0.631	0.606	0.675
						17.30	152	0.570	0.424	0.324
					Cell	removed		17.30.	26.	3.88
34	Lewis	40%	1/30	60	20.3.88	9.30	0	0.795	0.115	1.662
						10.0	½	0.764	0.100	1.761
						12.0	2½	0.767	0.089	1.815
				67		17.30	8	0.782	0.064	1.893
				68	21.3.	8.30	23	0.736	0.062	1.860
				69		17.30	32	0.740	0.057	1.848
				70	22.3.	8.30	47	0.705	0.064	1.775
				72		17.30	56	0.702	0.050	1.830
				73	23.3.	8.30	71	0.676	0.066	1.614
				77		17.0	79½	0.678	0.064	1.692
					24.3.	9.30	96	0.659	0.055	1.615
						16.0	102½	0.672	0.074	1.626
				78	25.3	9.30	120	0.652	0.284	1.111
					26.3	8.30	143	0.588	3.587	0.150
					Cell	removed				

65.

Cell No.	Nature of Metal	% by weight	R in ct.	Page	Date	Time	Hours for Start	EMF	I.R.	C
35	Lead	45%	1/30	60	20.3.88	9.30	0	0.949	0.114	2.100
						10.0	½	0.942	0.092	1.792
						12.0	2½	0.784	0.084	1.812
				67		17.30	8	0.764	0.078	1.882
				68	21.3.	8.30	23	0.733	0.064	1.845
				69		17.30	32	0.722	0.061	1.833
				70	22.3.	8.30	47	0.720	0.076	1.755
				72		17.30	56	0.700	0.052	1.818
				73	23.3.	8.30	71	0.680	0.093	1.596
				77		17.0	79½	0.672	0.063	1.645
					24.3.	9.30	96	0.662	0.081	1.560
						16.10	102½	0.653	0.059	1.665
				78	25.3	9.30	120	0.598	0.112	1.344
					26.3.	8.30	143	0.632	2.677	0.210
					Cell removed.					
36	Lead	50%	1/30	60	20.3.88	9.30	0	0.776	0.086	1.728
						10.0	½	0.770	0.109	1.740
						12.0	2½	0.764	0.082	1.792
				67		17.30	8	0.748	0.062	1.190
				68	21.3.	8.30	23	0.732	0.062	1.852
				69		17.30	32	0.730	0.052	1.845
				70	22.3.	8.30	47	0.744	0.101	1.755
				72		17.30	56	0.716	0.060	1.821
				73	23.3.	8.30	71	0.666	0.102	1.531
				77		17.0	79½	0.667	0.084	1.515
					24.3	9.30	96	0.725	1.550	0.382
						Cell ~~[illegible]~~ removed nearly exhausted				
					16 o'clock	24.3.88				

Tuesday, 20th March contd.

A Lead Storage cell consisting of 60 leaden plates (exposed surface only) 8.5 cms wide 11 cms deep and about 1 mm thick seperated by an average distance of 2.17 mm was placed in an circulating trough. The exposed surface was thus about 119 sq. cms on one side of each plate and the total surface in action (2×30 − 1)(119) = 59 × 119 = 7021 sq. cms. say 7000.

Pyro carbon cell.
1 Zn/H. 58.2, 41.75 } 16.48 = 0.069

75% Borax
25% Sulphate of Barium } very low reading
Pt and C. Liquid + bubbling.
C. + element.

Copper and C. } very low reading
C. + element

Iron and C.
C. neg. element.

Nickel and C. } low reading
C. + element

Silver and C. } decreasing readings
C. + element.

50% Barium sulphate
50% Potassium sulphate } Unable to melt chemical.

75% Glacial phosphoric } 54.4
25% Barium sulphate } 45.8 } 5.6 = 0.6 volt
Cu and C. 2 R. 110
C. neg. element.

(66)

"Pendulum Induction Apparatus"

Results obtained on the 6th and 8th + 19th March

6th Mar.: 9 complete swings in 313 secs = 34.77 secs per vib.

Day Constant log 14th: 1st ½ vib = 455·5 } $\lambda = \frac{1}{2}\log_e \frac{455.5}{158.5} = 0.05865$ $1+\frac{\lambda}{2} = 1.029323$
= 158·5

Mean Power = 94·7. 0·4014 + 1·437 volts.

3.74747 watts/sec.

8th Mar.:

10 complete vibs in 325·5 secs = 32·55 secs per vib
1st ½ vib = 458·75 } $\lambda = \frac{1}{20}\log_e \frac{458.75}{150} = 0.05866$ $1+\frac{\lambda}{2} = 1.028334$
2nd - - = 150

10 complete vibs. in 330 secs = 33.0 secs per vib
1st ½ vib = 479 } $\lambda = \frac{1}{20}\log_e \frac{479}{157} = 0.05577$ $1+\frac{\lambda}{2} = 1.02788$
2nd - - = 157

10 complete vibs in 327·5 secs = 32·75 secs per vib
1st ½ vib = 480 } $\lambda = \frac{1}{20}\log_e \frac{480}{158} = 0.05556$ $1+\frac{\lambda}{2} = 1.02778$
2nd - - = 158

Mean T = 32·77 = 31·890. log: of the day constant
$1+\frac{\lambda}{2} = 1.0280$ = $\bar{3}.702118$
0·005262

19th Mar.:

10 complete vibs: in 351·5 secs = 35·15 secs per vib.
1st ½ vib: = 471 } $\lambda = \frac{1}{20}\log_e \frac{471}{135.5} = 0.06246$ $1+\frac{\lambda}{2} = 1.03115$
2nd - - = 135·5

10 complete vibs in 351 secs. = 35·10 secs per vib
1st ½ vib = 481 } $\lambda = \frac{1}{20}\log_e \frac{481}{135.25} = 0.06344$ $1+\frac{\lambda}{2} = 1.03172$
2nd - - = 135·25

10 complete vibs in 351 secs = 35·00 secs per vib
1st ½ vib = 469·25 } $\lambda = \frac{1}{20}\log_e \frac{469.25}{136.5} = 0.06120$ $1+\frac{\lambda}{2} = 1.03060$
2nd - - = 136·5

Mean T = 35·12½ secs.
Mean $1+\frac{\lambda}{2}$ = 1·03115 = 34·058

Constant for the day (19th) $T \times (1+\frac{\lambda}{2}) \times k$ = log T 1.5457555
log $\frac{\lambda}{2}$ 2.0131324
k 2.0171371
3.77260
C = 0.056572

8th Mar. 88 Time	Volts	Chrons	Magnetising Current. Sawtooth form	Rising form	Measured Sq.	Triangular Zigzag	Bell Ringing	Center Pointer deft.	Throw	Mean	C
10·39							Round	0·5	5		
·47							0		7		
·53							0		7	6·43	.0338
11·04							0		6·75		
·30	113·2	1 lamp + 35Ω	21°		-		0·05		7·5		
·34	112		-				-		9·5	8·5	.0447
·37	112		-				-		9		
·40	112		-				-		8		
·53	111	4 lamp + 5Ω	37°				0·10		10·5		
·57	112		-				-		9·75	10·19	.0536
12·05	114		-				-		10·5		
13·15	112		-				-		10·0		
·26	112	2 lamps + 35Ω	57°				0·20		14·75		
·30	112		-				-		13·75	14·38	.0757
·34	112		-				-		14·5		
·41	112		-				-		14·5		
·54	111·7	1 lamp + 95Ω	72°				0·40		21		
·58	112		-				-		21·5		
14·2	112		-				-		20·75	21·5	.1108
·7	112		-				-		22		
·17	112								22·25		
·24	112	1 lamp	8°	8°			1·0		47·75		
·38	112	125	-				-		53·75		
·42	111·7	125	-				-		53·25	53·25	.2802
·45	111	125Ω	-				-		52·75		
15·04	111	75Ω		12·30°			1·5		69·75		
15·08	111	85Ω		12°			-		70		
·12	112	85Ω		15°			-		71	70·4	.3717
·16	111	85Ω		12°			-		71·75		
·26	112	61Ω		16°			2·0		93		
·36	111	61Ω		-			-		93·5		
·40	111	61Ω		-			-		92	92·88	.4888
·45	111	61Ω		-			-		93		
16·6	111	50Ω		19·30			2·5		114		
·15	111	-		-			-		113		
·16	111	-		-			-		113	112·75	.5932
·22	111	-		-			-		112		
·33	111	42Ω		23	3.	13	3·0		136		
·39	111	-		23·30	3.	13	-		136	136	.7153
·42	111	-		-	3.	13	-		136		
·53	110	33Ω		24·30	3·9	14	4·0		163·5		
·57	110	-		-	3·9	14	-		163·5		
·24	110	-		-	3·9	14	-		161	162·5	.8550
17·30	110	-		-	3·9	14	-		162		

(4) 15th March 88

Time	Volts	Ohms	Mag: Current. Earthed	Acting Tot	Mean	Weight	Rockd Swing Tot	Inter plate Plat.	Mean	Mean	
11.35	113.4	Tamp + 50	0.05				0.05	0.Bm	.3		
.41	113.3	-	-				-	-	4		
.46	112.8	-	-				-	-	3.5	3.50	.0198
12.01	112	-	-				-	-	3.5		
13.15	112	1 Tamp + 770	0.10				0.10	-	6		
.20	112	-	6				-	-	5.5		
.24	110.9	-	-				-	-	5.25	4.83	.0273
.33	111.5	-					-	-	4.5		
.37	114.2								3.75		
.42	111.7								4		
.51	111.6	2 Tamp + 94	0.20				0.20		9.5		
.56	111.5	-	-						9.		
14.00	111.6	-	-						8.5	8.70	.0492
.04	112.3	-	-						8.5		
.10	112.2	-	-						9.0		
.18	112.3	1 Comp + 80	0.40				0.40		14.5		
.23	112.4	-	-						15.75		
.34	112.7	-	-						15.	14.75	.0834
.41	112.5	-	-						15.		
.45	112.7	-	-						14.25		
.47	112.6	-	-						14.		
15.22	114.1	115	8°				1.0		32		
.28	114.8	115							36.75		
.33	115.2	115							35.25	36.05	.2040
.35	115.2	115							37.5		
.39	114.2	115							34.75		
.49	113.1	83	12°	1.49	0.294	4.5			56		
.57	112.0	83	-	1.49	0.294	-			55.5		
16.03	112.3	83	-	1.50	0.292	-			55.75	55.94	.3165
.07	111.5	83	-	1.52	0.291	-			55.6		
.18	112.3	58	16°	1.92	0.416	2.0			76		
.24	112.3	58	-	1.94	0.416	-			76	76.00	.4300
.29	112.1	58	-	1.93	0.413	-			76		
.37	109.8	48	19° 30'	2.86	0.494	2.5			87		
.43	110.2	48	-	2.36	0.503	-			87.25	86.42	.4890
.52	110.9	48	-	2.38	0.501	-			85		
17.05	110.9	40	25°15'	3.00	0.601	3.0			105.5		
.09	110.3	40	-	-	0.600	-			106.25	104.42	.5907
.15	111.4	40	-	-	0.615	-			103.5		
17.25	116.3	31.5	29° 40	4.0	0.790	4.0			124		
.30	115.5	-	-		0.784	-			126	125.00	.7070
.37	115.	-	-		0.773	-			125		
.45	115.6	25	35° 50'	6.37	0.994	5.0			150		
.53	115.8	-	-	4.99	1.000	-			149.5	150.08	.8630
.58	113.7	-	-	5.0	.950	-			151		

The magnetising current in the Elementget: is reverse in the preceding or succeeding part of experiment to that

Pt and C. 53 / 47 } 6 = 0.41 volt
C + element — 3.R. 1.44

Iron and C. C. neg. element } very low readings.

Silver and C. C. neg. element } very low readings.

Nickel and C. C. neg. element }

75 % Glacial phosphoric acid / 25 % Sulphate of Calcium } Chemical boil. freely

Pt and C. C + element } very low readings.

Cu and C. C. neg element

	Iron and C. C. neg. element.		Silver and C. C neg element	Nickel and C. C neg element
17.30	Daniel's cells			
19	0.576	0.642	0.028	1.725
20	0.543	0.576	0.020	1.629
21	0.611	0.664	0.029	1.833
22	0.628	0.686	0.031	1.884
23	0.639	0.716	0.040	1.917
24	0.642	0.714	0.037	1.926
25	0.654	0.724	0.036	1.962
26	0.646	0.726	0.041	1.938
27	0.650	0.745	0.049	1.950
28	0.584	0.637	0.030	1.752
29	0.629	0.703	0.039	1.887
30	0.630	0.696	0.035	1.890
31	0.632	0.725	0.049	1.896
32	0.635	0.721	0.045	1.905
33	0.633	0.732	0.052	1.899
34	0.631	0.762	0.069	1.893
35	0.628	0.764	0.072	1.884
36	0.630	0.748	0.062	1.890

Wednesday 21st March.

No 19	0.030	0.306	3.067 ω	0.090
" 20	0.039	0.137	0.838	0.117
" 21	0.586	0.634	0.027	1.758
" 22	0.603	0.656	0.029	1.809
" 23	0.620	0.670	0.027	1.860
" 24	0.624	0.678	0.029	1.872
" 25	0.633	0.694	0.032	1.899
" 26	0.625	0.682	0.030	1.875
" 27	0.636	0.696	0.031	1.908
" 28	0.544	0.605	0.037	1.632
" 29	0.606	0.691	0.044	1.833
" 30	0.613	0.685	0.039	1.839
" 31	0.613	0.681	0.037	1.839
" 32	0.617	0.699	0.044	1.847
" 33	0.620	0.694	0.040	1.860
" 34	0.620	0.736	0.062	1.860
" 35	0.615	0.733	0.064	1.845
" 36	0.618	0.732	0.062	1.854

Tested the current carrying capacity of Mr Amin's 1000 feet of core as follows.

Res. of core at assumed temp. of building 21°C. = 1.451 ω − 0.990 = 0.461 ω.

By means of a number of lamps in cct. a current of about 25 ampere was sent through the coil for 5 mins and the res. at the end of that time was

1.4585 − 0.990 = 0.4685 ω

after about fifteen mins pause the another current of $\frac{3 \times 1.86}{0.165}$ or 36.22 amp by the Board PD 106 volts

and $\frac{3.162\sqrt{178}}{0.165}$ or 42.33 amp by the Siemens Dynamo

was sent for five mins through the coil and the res at the end of that time was

1.465 − 0.99 = 0.475 ω

The total rise of temp. corresponds to a rise in res. of 0.475 − 0.461 = 0.014 ω

0.014 : 0.461 :: x : 100 = 3.037 %

3.037 ÷ 0.385 = 7.8° C. rise.

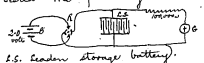
Tested the following connection.

C.S. Leaden storage (battery).
G dead beat Galvo
R hand reverser.

The deflection of the Galvo. through 0.12 was 135 divs from C.S. after the latter had been discharged for some time with a 2 amp. current. The independent current from the 2 cells of Daniell B was about the same.

Rotating the reverser did not therefore affect the current from C.S. passing through G to any appreciable extent within the limits of a single minute.

Tried the following.



The normal current from C.S. charged was about 135 divs on G, that from B about 130. The spot tended to oscillate between the points 5 when like poles connected and 270 when unlike poles joined. When the reverser was turned with sufficient rapidity, the spot remained fairly steady about 130, and the work done by the battery B became very small.

Pyro Carbon cell.

1 Ingl.	55·2 / 51·8	16·4	1.129 volt const 0.069

75% Borax 25% Calcium sulphate	Small pos. reading.
Pt and C. C. + element.	Thick fluid.

Cu and C. C. neg element	Small neg. reading.
Iron and C. C. neg. element	Small neg. reading.
Nickel and C. C. neg. element	Small neg. reading.
Silver and C. C + element.	Small pos. reading.
75% Borax 25% Borate of zinc.	C + 51·5 / 48·5 } 3 = 0·2 volt 3.R. 30ω
Pt and C. C. + element	Thick fluid. Formed alloys with all electrodes
Cu and C. C. + element	52·2 / 47·9 } 4·3 = 0·3 volt. 3.R. 16ω
Iron and C. C. neg. element	Small neg. reading.
Nickel and C. C. + element	Small pos. reading.
Silver and C C. + element	51·5 / 48·5 } 3 = 0·2 volt 3.R. 30ω
75% Glacial phosphoric 25% Borate of zinc	Small pos. reading. Consistency of boiling milk
Cu and C. C. + element	53 / 47·25 } 5·75 = 0·367 volt. 3.R. 20ω
Pt and C. C. + element	53 / 47·25 } 5·75 = 0·367 volt. 3.R. 20ω
Nickel and C. C. neg. element	Small neg. reading.

Silver and C. C. neg. element	Iron and C C. neg element	Small neg reading
45% Sulphate of Potash 55% Sulphate of Strontia		small pos. reading
Cathode Iron and C.		
Pt and C C. + element	52·5 / 48·2 } 4·3	= 0·3 volt. 3.R. 16ω
Silver and C. C + element	52·2 / 48·2 } 4	= 0·28 volt 3.R. 15ω

Lalande cell. 17.20.

	P.D.	E.M.F.	J.R.	C.	
No 19	0·626	0·236	2692	0·078	cells exhausted and removed
20	0·012	0·096	2·333	0·036	
21	0·561	0·603	0·025	1·683	
22	0·594	0·634	0·022	1·782	
23	0·612	0·660	0·026	1·836	
24	0·619	0·666	0·025	1·857	
25	0·625	0·667	0·022	1·875	
26	0·622	0·680	0·031	1·866	
27	0·630	0·696	0·035	1·890	
28	0·557	0·628	0·043	1·671	
29	0·603	0·662	0·035	1·809	
30	0·606	0·674	0·037	1·818	
31	0·604	0·661	0·031	1·812	
32	0·612	0·672	0·033	1·836	
33	0·614	0·694	0·043	1·842	
34	0·616	0·740	0·067	1·848	
35	0·611	0·722	0·061	1·833	
36	0·615	0·720	0·062	1·845	

(70)

Thursday 22nd March

F. 30. Lalande cells

21	0.010	0.146	4.747	0.030	Bell removed
22	0.577	0.620	0.025	1.721	
23	0.598	0.636	0.021	1.794	
24	0.604	0.644	0.022	1.812	
25	0.612	0.654	0.027	1.836	
26	0.608	0.664	0.031	1.824	
27	0.618	0.660	0.023	1.854	
28	0.513	0.616	0.067	1.539	
29	0.585	0.605	0.011	1.755	
30	0.588	0.652	0.036	1.764	
31	0.581	0.650	0.040	1.743	
32	0.596	0.652	0.031	1.788	
33	0.590	0.668	0.044	1.770	
34	0.592	0.705	0.064	1.776	
35	0.586	0.720	0.076	1.758	
36	0.586	0.764	0.101	1.758	

Pendulum results of Mar. 20th and 21st

20th Mar. 10 complete vibs. in 351 sec $T = 35.10$

1st semiarc 475.75 } $\lambda = \frac{1}{20}\log_e \frac{475.75}{132} = 0.06410$
2nd " 132 } $1+\frac{1}{2} = 1.03205$

10 complete vibs in 351 sec $T = 35.10$

1st semiarc 482 } $\lambda = \frac{1}{20}\log_e \frac{482}{131} = 0.06515$
2nd " 131 } $1+\frac{1}{2} = 1.03257$

10 complete vibs in 352.5 sec $T = 35.25$

1st semiarc 456.25 } $\lambda = \frac{1}{20}\log_e \frac{456.25}{126} = 0.06513$
2nd " 126 } $1+\frac{1}{2} = 1.03257$

Mean $T = 35.15$ = 34.047 Corr of day cent: 5.75648
Mean $1+\frac{1}{2} = 1.03240$ 0.02589

21. Mar. 10 complete vibs in 358.5 sec $T = 35.85$

1st semiarc 478.75 } $\lambda = \frac{1}{20}\log_e \frac{478.75}{127} = 0.06638$ $1+\frac{1}{2} = 1.03317$
2nd " 127 }

10 complete vibs in 358 sec $T = 35.80$

1st semiarc 458.5 } $\lambda = \frac{1}{20}\log_e \frac{458.5}{128} = 0.06817$ $1+\frac{1}{2} = 1.03409$
2nd " 128 }

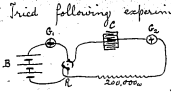
Mean $T = 35.825$ = 34.659 Corr Day cent
Mean $1+\frac{1}{2} = 1.03363$ 34.659 5.76236
0.02584

20th Mar. 88 Times	Bells	Mins	Mags. C	Current. Ambrey	Kings	Abel	Mersey	Bad Swing	Better Better Tries	Thirds	Mean	
10.39	-	-	0					7	1.0m	2.5		
-43	-	-								2.5		
-58										2.	2.40	.0136
11.01										2		
-07										3		
-54	113.2	7 Complete	0.05	0.05						4.25		
-59	111.7	"								4.75		
12.05										3.75 8	4.050	
15.18	111.8	- -	0.05	0.05						3.25	3.875	.0220
-24	112.2	- -								3.75		
-32	112.2	- -								3.50		
-39	118.4	12 Complete	0.10	0.10						4.25		
-45	111.7	- -								3.0		
-48	119.4	- + 835								4.25		
-54	118.8	- -								5.25	4.50	.0255
16.06	118.8	- -								5.5		
-08	112.2	- -								4.75		
-13	112.2	20 Complete	0.20	0.20						7.		
-18	112.1	- -								4.25		
-21	112.1	- -								7.50	7.18	.0407
-25	110.9	- -								6.75		
-29	110.4	- -								7.25		
-35	112.1	12 Complete	0.40	0.40						13.25		
-40	112.2	-								12.		
-44	112.2									12.	12.60	.0714
-47	111.9									13		
-51	111.4									12.75		
17.01	111.8	12.5	1.00		8".	0.150	0.95			28		
-05	112.0	-								29.5		
-13	111.9	-					0.34			28	28.44	.1613
-16	112.5	-				0.151	0.93			26.25		
-21	112.9	80	1.50		12"	0.233	1.45			44.75 7		
-26	111.5					0.235	1.44			48.75		
-32	111.9					0.233	1.43			47.00	47.21	.2620
-37	111.9					0.233	1.44			44.75		
-42	111.5					0.233	1.44			46.		
-45	112.4					0.233	"			47		
-52	114.4	60	2.0		16"	0.306	1.93			64.25		
-57	112.0					0.305	1.99			64.0		
18.03	112.0					0.306	1.98			63.75	63.44	.3597
-08	111.2					0.306	1.98			62.75		
-10	111.3	48	2.5		19.50	0.386	2.45			85.25		
-13	111.3					0.387	"			84.		
-27	112.0					0.389	2.50			87.	86.62	.4854
-31	111.7					0.386	2.50			86.25		
-49	111.6	40	3.0		23"	0.457	3.0			96.25		
-57	112.0					0.457	3.0			94.75		
-59	112.7					0.460	3.02			95.75	95.58	.5419
19.00	112.1	24.5	4.0		29.50	0.608	4.15			122.25		
-04	111.5				29.50	0.631	4.15			120.75		
-10	111.3	30.75			29.50	0.632	4.11			120.25	121.8	.6906
-18	111.8	20.5	5.0		35.50	0.759	5.05			144		
-23	110.9	-					"			140.5	141.2	.8002
-27	111.2	-				0.758	"			142		

(1) 21st Mar. 88.

Time	Volts	Ohms	C.	Brightness	Ring by Clock	Means	Swing	Lateral Dist.	Throw	Mean	
9.20			0				7°	1.5	3		
25			0						3.5		
35			0						3.5	3.44	.0191
37			0						3.75		
10.11	114.5	1 lamp + 6 ex.	0.05	0.05					5		
16	114.2								4.25		
16	113.7								4.25	4.50	.0260
19	113.2								4.5		
33	112.5	2 lamps + 5	0.10	0.10					5.5		
40	113.2								4.75		
46	113.2								5.5	5.42	.0314
49	113.2								5.1		
54	113.7	2 lamps + 1 ex	0.20	0.20					8		
57	113.5								8.5		
11.01	113.5								8.5	8.35	.0483
03	113.2								8.4		
13	113.2	1 lamp + 6 ex.	0.40	0.40					13.5		
16	113.2								13.25		
25	113								13	13.05	.0755
31	111.7								12.75		
39	113								12.75		
46	113.2	1.20	1.0		5°				30		
52	112.4	116.2							29.75		
55	112.7	115.5							30	29.80	.1724
59	112.5	115.0							29.75		
12.2	110.7	114.5							29.5		
13.15	112.2	52.	1.5		12°	0.25	1.5		46.5		
16.0	96.2	91				0.185	1.3		40.5		
16.5	97.2	81				0.185	1.3		40	41.62	.2407
19	97.2	81				0.185	1.35		40.5		
15	96.7	75	2.0		16°	0.215	1.5		46.5		
20	95.7	76				0.215	1.5		47		
"	96.2	60				0.216	1.5		55.5	50.87	.2943
	96.7	60				0.216	1.5		54.5		
16.55	96.2	41	2.5		19.50	0.318	2.5		66.5		
17.05	95.8	41				0.325	2.5		64	64.25	.3717
12	96.46	37	3.0		22.50	0.430	3.0		81.5		
19	96.25	36.5				0.434			82.0	81.75	.4729
24	97.9	25	4		29.50	0.582	4.25		104		
29	98.5	25				0.575			104.5	104.25	.6030
33	97.3	20	5		35.50	0.716	5.33		123.25		
36	97.7	20				0.716	5.31		120	121.42	.7023
40	97.0	22				0.715	5.33		121		

Tried following experiment.



B. 3 Daniell cells.
G_1 Deadbeat Galvo.
G_2 " "
C storage cell
R. Reverser.

At 13.31 / 13.43 C was charged by a current of about 1 ampere from the Dynamos.

The deflection on G_1 while the reverser R was quiescent and C out of circuit was +90 divs.

That on G_2 ±260, both deflections steady, the current being about $\frac{3}{200,000}$ ampere (approx).

The deflection on G_1 while the reverser R was worked by hand with fair speed C still out of circuit was about 85, that on G_2 varied between +260 and −260 remaining not far from the zero-point.

The deflection on G_1 while the reverser was quiescent and C in circuit (+ to + or in opposition) was +36 that on G_2 +105.

The deflection on G_2 while the reverser was quiescent and C in circuit but (− to + or in support) was 146 that on G_2 −419.

The mean of these deflections are for G_1 +91 for G_2 −157

When the reverser was now worked by hand at fair speed, the deflection of G_1 remained at about 80 while that of G_2 took up a position about −135, varying somewhat with the rate of reversal.

That is to say while the current from the cell C would have produced on ~~G1~~ G_2 about −155 divs with B out of circuit, the alternation of B brought the current to about −135, and while +85 was the deflection on G_1 with the reverser worked and C removed, the interposition of C in the circuit only brought that deflection to +83.

(3) Lalande: cell 17.30.

No 22	0.579	0.610	0.018	1.737
23	0.601	0.640	0.022	1.803
24	0.608	0.656	0.026	1.824
25	0.616	0.648	0.017	1.848
26	0.614	0.650	0.020	1.842
27	0.622	0.666	0.024	1.866
28	0.052	0.316	1.693	0.156 bell removed
29	0.588	0.604	0.009	1.764
30	0.588	0.604	0.009	1.764
31	0.587	0.604	0.010	1.761
32	0.602	0.655	0.029	1.806
33	0.594	0.660	0.032	1.782
34	0.610	0.702	0.050	1.830
35	0.606	0.700	0.022	1.818
36	0.607	0.716	0.060	1.821

Ballistic Constant 22. 3. 88.

10 Complete vibs: occupied 35325 secs $T = 35.325$

The 1st semi vib = 462 } $\lambda = \frac{1}{20}\log\frac{462}{129.5} = 0.0683944$

- 21st - = 129.5 } $1+\frac{1}{2} = 1.03480$

10 Complete vibs occupied 351.75 secs $T = 35.175$

the 1st semivib = 443.25 } $\lambda = \frac{1}{20}\log\frac{443.25}{123.25} = 0.063996$

- 21st - = 123.25 } $1+\frac{1}{2} = 1.03200$

10 Complete vibs occupied 354.25 secs $T = 35.425$

The 1st semivib = 466 } $\lambda = \frac{1}{16}\log\frac{466}{166} = 0.062444$

17th - 166 } $1+\frac{1}{2} = 1.03125$

Discharged at 17 o'clock from condenser with 1 Clark cell @ temp. 22°.5 C = 1.430 volt @ follows:-

Elliott established 1st (run up to 0.5)

127.25	+	Mean T = 35.308	
126	+	$\times 12\frac{1}{2} = 1.03197$	
126	−		
124	−		
124	−	125.625 × 1.032 × 35.308	
125.5	−	= 4577.2	
126	−		
125	−	log h = 3.6611	
126.25	−		
126	−		

General Mean 125.625

0.5 ↑ weighty 125.75

Schematically Elliott 1st Standard 0.5↑

102.25 { 102, 102.5

$\frac{102.25}{125.625} \times 0.5 = 0.408$ ↑ see page 52.

Log. of day unit $\bar{3}.755235$, 0.005692

Time	Bells	Chrono	C.	Comb'ns	Recy	Blank	Mean	Swing	Inst'l Det	Throw	Mean	
10.38	146.2	148	0					7°	2mm	2		
·11										2.25		
·11										2.5		
·11										2		
·25	114.2	Temp 4 + 30	0.05	0.05		0.0978				2.5	2.19	.0125
·28	115.2									2.5		
·32	114.2									2.75		
·42	114.2									2.5		
·52	114.2									3.75		
·54	114.7									3.5		
·59	113.2	2 Lamp + 30	0.10	0.10		0.01				4.75	2.97	.0169
11.04	114.7									2.25		
·09	113.0									4.25		
·15	113.0									3.75		
·18	113.7									3.25		
·23	113.2									4.15		
·34	113.2	2 Lamp + 64	0.2	0.20		0.025				6	4.67	.0266
·37	113.7					0.025				6.25		
·40	112.0					0.025				5.75		
·53	113.7					0.025				6		
·58	112.7	1 Lamp + 76	0.4	0.40		0.78				10.5	5.85	.0333
12.01	112.6					0.77				11.5		
13.15	111.7	1 Lamp + 72				0.72				10.25		
·19	111.5					0.72				11		
·23	111.9					0.72				10		
·25	112.2					0.71				9.75		
·29	112.6					0.72				10.5		
·38	112.6	118	1.0		8°	0.173	0.80			35.75	10.51	.0598
·41	112.8	117				0.173	0.80			24.5		
·46	112.8	118				0.174	0.80			24		
·52	112.6	118				0.174	0.80			24		
·59	112.2	88	1.5		12°	0.272	1.37			35.4	34.56	.1398
14.02	113.	85				0.272	1.30			35.0		
·10	114.9	85				0.272	1.30			35.75		
·16	111.2	85				0.270	1.30			35.15		
·24	112.2	58	2.0		16°	0.369	2.00			48.75	35.32	.2011
·31	112.3	59			16°	0.369	1.99			45.5		
·37	112.6	59			16.4°	0.368	2.00			49.2	48.49	.2760
·50	113.1	59			16°	0.369	2.00			48		
·56	112	58			16°	0.369	2.00			48		
15.09	111.8	47	2.5		19.5°	0.446	2.43			58	58.10	.3307
·06	112.5	47				0.446	2.42			57		
·11	111.2	47				0.445	2.41			57.25		
·18	111.5	46				0.445	2.43			58.5		
·23	112.7	46				0.446	2.43			59.75		
·33	117.5	38	3.0		23.75	0.526	3.0			70.25	69.66	.3966
·40	112.	38				0.523				69		
·45	111.7	38				0.526				69.5		
·48	112.7	38				0.525				70.		
·56	117.6	32.5	4.0		29.75°	0.701	4.0			88	86.9	.4947
16.02	111.0				29.5°					86.5		
·22	112.					0.695				86.2		
·29	110.2	23.5	5.0		35.30	0.876	5.16			104	105.9	.6028
·35	111.2	23.5				0.877	5.14			106.75		
·40	111.6	23.5				0.876	5.15			106.75		
·45	111.9	23.5				0.879	5.22			106.		

Friday 23rd March.

8.30 Lalande cells.

No 22.	0.012	0.1140	3.555	0.036 all second
23	0.571	0.621	0.029	1.713
24	0.440	0.632	0.1145	1.320–1.740
25	0.587	0.632	0.026	1.761
26	0.584	0.636	0.030	1.752
27	0.590	0.645	0.031	1.770
28	0.549	0.620	0.043	1.647
29	0.548	0.620	0.044	1.644
31	0.548	0.614	0.040	1.644
32	0.566	0.625	0.035	1.698
33	0.548	0.620	0.044	1.644
34	0.538	0.676	0.086	1.614
35	0.532	0.680	0.093	1.596
36	0.510	0.666	0.102	1.530

10.10 Tested a new Chromic acid cell as follows before commencing work

No 37	0.957	2.050	0.405	2.871
·13 No 37 left at work on ⅛ G.S. wire.				
·45	0.985	2.022		2.955
13.0	0.856	1.997		2.568

Tested a transformer for continuous currents arranged as follows:–

8 closed electromagnets are arranged radially round a commutator. The windings on the coil are two, one of short thick wire of less than one ohm's resistance while the other was a long fine secondary coil of about 80 ohms resis: By bridging the terminals of these primaries and also of these secondaries we always 4 apart. The primary resis: being about 0.7 the secondary resis: about 350.

On connecting the secondary coils to the Dynamo mains a current of about $\frac{113}{350}$ or 0.32 amp would pass through the apparatus steadily and the amount of work energy absorbed would be

$113 \times 0.32 \times 10^7 = 3.62 \times 10^8$ erg: per sec:

By means of multiplying gear worked by hand, one rev: of the hand wheel was made to effect about 10.75 revs: of the commutator. With an average speed of the handle in revs: per min: the average speed of the commutator was thus known. The (primary) coils were now connected with the tang: Obach ring through a res: in lead of 0.3. The current at different speeds was then observed.

(1) at about 1.6 revs: of contr per second 0.9 amperes was obtd.
(2) " " 4.3 - - - - - - 1.8 - - -
(3) " " 7.1 - - - - - - 1.3 - - -
(4) " " 12.5 - - - - - - 0.8 - - -
(5) " " 21.3 - - - - - - 0.4 - - -
(6) " " 30.0 - - - - - - 0.3 - - -

The maximum current that could be obtained was about 1.8 amperes, and the speed of the commutator in trial no 2 was kept at about that necessary for this purpose.

The energy in the primary circuit of short wire, that is to say the secondary circuit in this case was at the maximum

$1.8 \times 1.8 \times 1 \times 10^7 = 3.24 \times 10^7$ ergs: per sec:

In trial no 3 the P.D. at the terminals was obtd: to be 0.36 volt which gives for the current in that case $\frac{0.36}{0.3} = 1.2$ amperes agreeing very fairly with that observed by the Obach.

The maximum efficiency was thus $\frac{3.24}{3.62}$ or 89.5% but the efficiency was probably a little greater than this since no allowance was made for counter EMF in the Dynamo circuit.

Took following test of the standardising Bureau Bridge over Troy bridge being at about 67°F. the other at probably only 40° to 50°F, it is by Bureau of B.S.W.

Bridge	Ratio B.d.O.	Troy equivalent L.O.
line	1000	980·5
-	100	98·3
-	10	9·88
Bridge	10	9·89
-	100	98·35
-	1000	981
	5000 coil	4890.
	2000 -	1962
	1000 -	∞
	1000 -	982·0
	500 -	490·5
	200 -	196·5
	100 -	98·3
	100 -	98·2
	50 -	49·2
	20 -	19·7
	10 -	12·3
	10 -	10
	5 -	4·95
	2 -	2·
	2 -	2·5
	1 -	1.

Physo Cairns cell 22nd Mar. 88.

1 Agll 16.35 Constant 0.069.

80% Borax
20% Chloride of Strontia } 55·7 / 45 } 10.7 = 0·73 volt. D.R. 14w
Pt and C. Consistency of dough.
C. + element Unable to insert other electrodes.

25% Glacial phosphoric
75% Chloride of strontia } 54 / 46 } 8 = 0·55 volt D.R. 30w
Pt and C.
C. + element

Bis and C.
C. neg. element } Small neg: reading.

Silver and C
C. neg. element } - - -

Iron and C.
C. neg. element } - - -

Nickel and C
C. neg element } - - -

75% Chloride of lead
75% Glacial phosphoric } Clear liquid. Formed combination with all electrodes
Pt and C.
C. + element } Falling pos reading

Bis and C.
C. neg element } Small neg reading

Silver and C
C. + element } Small pos. reading.

Nickel and C
C. neg. element } Small neg reading

Iron and C.
C. neg. element } Small neg reading.

Made mixture of Chloride of strontia and sulphate of potash which took hard crust under heat. Unable to insert electrodes.

75

75% Borax
25% Chloride of lead. } Melted rapidly. Boiled well and clear fluid. electrodes
Cu and C. C. + element Small readings

Pt and C. } 51.2
C. + element } 49.2 } 2 = 0.138 volt
Res loss than 1w.

Iron and C. } Small neg. results
C. neg. element

Nickel and C. } Small pos. results
C. + element

23. 3. 88

1 Ag Cl. 16. Constant 0.07.

15% Kalium Stibite } Pasty condition.
85% Borax

Pt and C. } 54
C. + element } 45.6 } 8.14 = 0.588 volt
Res. 9w.

Cu and C. } 52.5
C + element } 47.5 } 5 = 0.35 volt
3.R. Res. 3w

Nickel and C. } 51
C. + element } 49 } 2 = 0.14 volt
3. R. 3w.

Iron and C. } Small neg. result
C. neg. element

Silver and C } 52.7
C. + element } 47.3 } 5.14 = 0.378 volt
3 R. 6w

50% Kalium Stibite } boiled freely at low temp.
50% Glacial Phosphoric

Silver and C. } Small neg. reading.
C neg element

Cu. and C. } Small neg. reading.
C. neg element

Nickel and C. } Small neg. reading
C. neg. element

Pt. and C } 53.5
C. + element } 46.5 } 7 = 0.49 volt.
3.R. 14.0w

50% Arsenic sulphide } Formed combination with electrodes
50% Borax

25% Phosphate of Magnesia } Chemical in clear fluid state
75% Glacial phosphoric

Cu and C. } Large neg. effect.
C. neg element

Iron and C } 46.5
C. neg. element } 53.5 } 7 = 0.49 volt.
3, R. below 1w

Silver and C. } Small neg. reading.
C. neg. element

Platinum and C } 51
C. neg. element } 49 } 0.14 volt.

Nickel and C. } Small neg. reading
C. neg. element

75% Borax } Formed combination with electrodes
25% Phosphate of Magnesia

50% Glacial Phosphoric } Clear liquid fluid.
50% Sulphite of Magnesia

Cu and C } Fair neg reading
C neg. element

Silver and C. } Small neg. reading
C. neg. element

Pt and C } 53.5
C. + element } 46.5 } 7 = 0.49 volt
3 R. 10w

Iron and C. } Fair neg. reading
C. neg element

Nickel and C
C. neg. element

50% Sulphite of Magnesia } Fluid and clear.
50% Borax

Cu and C. } Small pos. readings
C. + element

Nickel and C
C. + element

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Iron and C. } Small neg. reading
C. neg. element

Silver and C. } Small pos. reading
C. + element

Pt and C. } Small pos. reading
C. + element

50% Sulphate Potash } Unable to melt.
50% Magnesia Sulphate } Pasty form.

Pt and C } Small + reading
C. + element

Cu and C. } 53.5 } 7 = 0.48 volt
C neg. element } 46.5 } J.R. 700

Iron and C.
C. neg. element } Small neg. reading

Silver and C. } 53 } 6 = 0.42 volt
C. + element } 47 } J.R. 1000

Nickel and C } Small pos. reading
C ~~neg~~ + element

Pendulum Ballistic measurements.

23rd Mar. 88.

10 Complete vibs: in 339 secs T = 33.9 secs $\lambda = .058772$

1st semiarc = 446.25 } $\lambda = \frac{1}{20} \log_n \frac{446.25}{137.75}$ $1 + \frac{1}{4} = 1.027386$
2nd " = 137.75 } $\log_n$

10 Complete vibs: in 345.25 secs T = 34.625 $\lambda = .058975$

1st semiarc = 440.75 } $\lambda = \frac{1}{20} \log_n \frac{440.75}{135.5}$ $1 + \frac{1}{4} = 1.027487$
2nd " = 135.5 }

10 Complete vibs: in 346.25 secs T = 34.625 $\lambda = .061172$

1st semiarc = 446.25 } $\lambda = \frac{1}{20} \log_n \frac{446.25}{131}$ $1 + \frac{1}{4} = 1.030586$
2nd " = 131 }

Day Const 0.00553
Log = 3.74 2440

Time	Volts	Ohms	C	Combst	Pure Tot	Obsch.	Endothm Sorng.	Sulphur Dist.	Thermo	Mean	
			0				7°	2.5cc			
11.10									2.		
14									2.75		
16									2.75	2.40	.0133
20									2.7		
28	113.0	7 Lamps	0.05	0.05	0.00975	0.00975			3.3		
33	113.0	+ 100	0.05		"				3.25	3.05	.0169
37	112.2				"				2.2		
40	111.7				"				2.3		
48	113.2				"				2.5		
56	113.2	4 Lamps	0.10	0.10	0.0195	0.0150			1.		
59	113.2	+25							2.1		
2.02	113.5								2.	3.97	.0220
13.10	113.9								1.		
15	112.7								3.75		
26	113.4	2 Lamps	0.2	0.2		0.033			10.25		
30	112.6	+ 73							5.	4.79	.0265
33	112.4					0.034			2.9		
43	113.8								2.0		
59	112.7	1 Lamp	0.34	0.4					8.0		
4.02	113.2	+ 40							8.4		
07	113.7								8.5	8.55	.0473
08	113.8								9.5		
17	113.3								8.35		
25	113.4	114	1.0		8°				21.2		
31	112.2	114							21.25		
40	112.5	114				0.195			20.6	20.96	.1159
46	112.0	114				0.185			21.0		
55	110.3	75	1.5		12°	0.271			28.25		
59	111.0	75				0.270			30.5		
15.03	111.0	75				0.274			31.5	30.20	.1670
07	110.2	75				0.245			30.75		
16	110.7	75				0.272			30.25		
15	111.2	55	2.0		16°	0.365			41.5		
30	110.8	55				0.365			40.5		
35	110.6	55				0.365			41.1	41.25	.2281
39	110.2	55				0.364			41.6		
46	112.2	45	2.5		19°30'	0.550?			53		
49	110.6					0.550?			52.9		
52	111.0					0.550?			52.75	53.23	.2944
55	111.2					0.547			53.75		
16.03	111.2					0.549			53.5		
07	110.6					0.546			53.		
16	110.5	40	3.0		23°	0.583			64.		
16	109.6					0.586			63.9		
21	110.3					0.585			64.2	63.77	.3527
26	111.1					0.584			64.25		
35	109.5					0.589			64.5		
38	110.0					0.585			63.25		
42	109.3	31.25	4.0		29°30'	0.715			79.5		
46	109.3					0.715			80.		
50	109.2					0.716			79	80.10	.4430
55	111.14					0.720			80.9		
17.04	109.5	23	5.0		35°30'	0.848			97		
09	109.7					0.849			98		
12	109.5					0.849			96.75	96.44	.5333
15	112.7					0.847			97.		

(71) Lalande cells. 17 o'clock

	E.M.F.	3.8.	C.
No 23.	0.5760	0.6260	0.029	1.728
- 24	0.5850	0.6340	0.028	1.755
- 25	0.5930	0.6370	0.025	1.779
- 26	0.5920	0.6370	0.025	1.776
- 27	0.5980	0.6520	0.030	1.794
- 29	0.5570	0.6280	0.043	1.671
- 30	0.5540	0.6080	0.033	1.662
- 31	0.5550	0.6240	0.042	1.665
- 32	0.5740	0.6280	0.031	1.722
- 33	0.5600	0.6360	0.045	1.680
- 34	0.5640	0.6720	0.064	1.692
- 35	0.5650	0.6720	0.063	1.695
- 36	0.5050	0.6470	0.094	1.515
- 37	0.5200	2.000	0.948	1.560

9.30 o'clock. Saturday 24th March.

No 23.	0.5540	0.6000	0.028	1.662
- 24	0.5640	0.6160	0.031	1.692
- 25	0.5710	0.6200	0.029	1.713
- 26	0.5760	0.6260	0.029	1.728
- 27	0.5800	0.6320	0.030	1.740
- 29	0.5330	0.5930	0.037	1.599
- 30	0.5280	0.6000	0.046	1.584
- 31	0.5240	0.5970	0.047	1.572
- 32	0.5500	0.6270	0.047	1.650
- 33	0.5320	0.6140	0.054	1.596
- 34	0.5050	0.6380	0.065	1.515
- 35	0.5200	0.6620	0.081	1.560
- 36	0.1280	0.7250	1.55	0.384
- 37	0.1170	2.040	5.2	0.351

at 10.30 added some sulphuric acid to no 37 where P.D. then rose to 0.7140

No 36 removed, nearly exhausted

16.0. 23.	0.5660	0.6110	0.027	1.698
24	0.5740	0.6220	0.016	1.722
25	0.5840	0.6340	0.029	1.752
26	0.5880	0.6400	0.030	1.764
27	0.5920	0.6320	0.023	1.776
29	0.5670	0.6180	0.030	1.701
30	0.5420	0.5560	0.033	1.626
31	0.5360	0.6020	0.022	1.608
32	0.5640	0.6190	0.023	1.692
33	0.5470	0.6120	0.040	1.641
34	0.5420	0.5720	0.079	1.626
35	0.5550	0.6530	0.059	1.665
37	0.3010	2.040	1.926	0.903

Nos 38 + 39 were made up of 30% and 35% caustic soda respectively, but not set to work.

Ballistic Galvanometer Constants as follow.

10 Complete vibs in 341.5 secs = 34.15 per vib = T.

1st semivib = 442.25 } $\lambda = \frac{1}{20} \log_e \frac{442.25}{134} = .059702$

2nd - = 134 } $1+\frac{\lambda}{2} = 1.029851$

10 Complete vibs in 343.75 secs = 34.375 per vib = T.

1st semivib = 470.25 } $\lambda = \frac{1}{20} \log_e \frac{470.25}{141} = .060225$

2nd - = 141 } $1+\frac{\lambda}{2} = 1.030113$

10 Complete vibs in 345.25 secs = 34.525 per vib = T

1st semivib = 409.25 } $\lambda = \frac{1}{20} \log_e \frac{409.25}{121.75} = .060618$

2nd - = 121.75 } $1+\frac{\lambda}{2} = 1.030309$

Mean T = 34.35

Mean $1+\frac{\lambda}{2}$ = 1.030009

Constant for the days = 0.00553

$\log_e$ = 3.742251

Time	Volts	Ohms	C	Earth	Ring	Head		Swing	Dials	Power	Mean	a
10.03	-	-	0						7'	Some	2.	
·06											1.25	
·11											2.00	1.62	.00896
·14											1.25	
·24	112.8	Thermp. [illegible]	0.05	0.05							3.00	
·29	112.0										3.35	
·32	112.2										2.9	
·40	112.2										3.0	3.13	.0173
·47	112.2										3.65	
·57	113.										3.85	
·57	112.4	Lamp [illegible]	0.10	0.10							4.5	
·59	112.8										4.5	
11.04	113.2										4.25	4.35	.0241
·09	113.3										4.5	
·13	112.3										4.0	
·18	110.5	Lamp [illegible]	0.20	0.20							5.5	
·21	112.1										5.25	
·26	112.4										5.1	5.24	.02898
·33½	112.8				0.201						5.1	
·39½	111.5	Lamp [illegible]	0.4	0.40							9.00	
·50	112.9										8.25	
·53	112.0										8.15	8.13	.04496
·57	110.5										8.00	
12.00	110.7										7.35	
·02	111.2										8.00	

Current off mains during afternoon

Sunday 25th March

9.30.

No 23	0.00	0.052	∞	0
· 24	0.548	0.594	0.030	1.644
· 25	0.556	0.602	0.028	1.668
· 26	0.560	0.622	0.037	1.680
· 27	0.565	0.622	0.034	1.695
· 29	0.0	0.078	∞	0
· 30	0.510	0.584	0.048	1.530
· 31	0.504	0.604	0.066	1.512
· 32	0.532	0.608	0.048	1.596
· 33	0.516	0.582	0.043	1.548
· 34	0.327	0.682	0.284	1.111
· 35	0.448	0.598	0.112	1.344
· 37	0.028	2.060	36.284	0.056
· 38		0.674	not at work	
· 39		0.756	- - -	

Monday 26th March

8.30

No 23	0	0.006	—	0 Bell removed
· 24	0.0	0.085	—	0 do.
· 25	0.510	0.590	0.052	1.530
· 26	0.517	0.584	0.043	1.551
· 27	0.526	0.602	0.048	1.578
· 29	0	0.020	—	0 Cell removed
· 30	0.132	0.168	0.091	0.396 do
· 31	0.006	0.116	0.110	0.018 do.
· 32	0.481	0.576	0.066	1.443
· 33	0.225	0.634	0.606	0.675
· 34	0.050	0.588	3.587	0.150 Bell removed
· 35	0.070	0.632	2.677	0.210
· 37	0.008	1.422	594	0.024
· 38	0.564	0.606	0.025	1.692
· 39	0.546	0.660	0.070	1.638

Nos 38 + 39 set to work —

79 Tested the coils of Mr Seubert's wire bridge as follows. 1ω = 1.01ω by Ivy bridge
10ω = 9.99ω - - -
100ω = 100.165ω - - -

∴ Repeated test of transformer efficiency, section the cams at a slight angle only, the primary being about 8° in advance.
16.30 o'clock.
The current in the primary or thin wire coil was observed on the Enfield Galvo. to be about 0.19 amp. (temp in cct.) but on rotating the commutator at about its best speed the current fell to 0.075 amp. The P.D. at the mains was about 111v. The energy supplied was thus 111 × 0.075 = 8.325 Watts.

The secondary or thick wire circuit was composed of the coil averaging about 0.7ω and leads and Oberch ring about 0.15ω. The res: would thus be about 0.85ω, and the current on the Oberch was observed to be 2.6 = 1.4 amperes when the handle made 90 revs: per min that is 90 × 10.8 = 972 per min = 16.2 revs: of the conti per sec: The energy thus delivered = 1.4 × 1.4 × 0.85 = 1.67 Watts per sec. The efficiency was therefore 1.67/8.325 = 20.0%

When the lamp was removed from the primary cct. the current in it was observed to rise to 0.3 amps: which is about what would be expected from the figure on page 73. The energy delivered was thus about 0.3 × 113 = 34 Watts but on revolving the handle the current fell to 0.098 amp or 113 × 0.098 = 11.074 Watts. The current delivered was 3.35/0.85 = 1.81 amps when the handle made 98 revs per min ∴ the conti made 1058.4 per min = 17.64 per sec. The energy delivered was 1.81 × 1.81 × 0.85 = 2.785 Watts
the efficiency = 2.785/11.07 = 25.1 %

Lalande cells. 17. 30.

No. 25	0.540		0.584	0.025	1.620
- 26	0.545		0.600	0.034	1.635
- 27	0.552	-	0.618	0.040	1.656
- 32	0.518		0.610	0.059	1.554
- 33	0.108	removed.	0.570	1.426	0.324
- 37	0.029		2.040	23.460	0.087
- 38	0.595		0.658	0.037	1.785
- 39	0.594		0.607	0.035	1.782

The pendulum ballistic results were as follow.

10 Complete vibs in 34.5" = 34.5 = T.
1st semiint = 425 } $\lambda = \frac{1}{20} \log_e \frac{425}{115.25} = .065249$
2nd - = 115.25 } $1 + \frac{1}{2} = 1.032625$

10 Complete vibs in 34.675" = 34.675 = T.
1st semiint = 407.5 } $\lambda = \frac{1}{20} \log_e \frac{407.5}{111.75} = .064689$
2nd - = 111.75 } $1 + \frac{1}{2} = 1.032345$

10 Complete vibs in 34.6" = 34.6 = T.
1st semiint = 461.5 } $\lambda = \frac{1}{20} \log_e \frac{461.5}{122.75} = .066216$
2nd - = 122.75 } $1 + \frac{1}{2} = 1.033108$

Mean T = 34.592 Day Const. = 0.00558
Mean $1 + \frac{1}{2} = 1.032693$ log = 8.74666

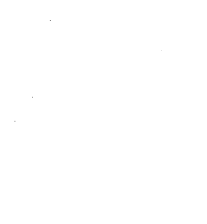
Set up the chronograph

90 Time	Volts	Phase	Magnetising C. C.	Pinhole	Ring	Block	Swing	Footer Footer Back	Floor	Mean
10.41			0				7"	4"	1.4	
.45			0						2.	
.49									1.4	1.77
.52									2.15	
.54									1.9	
11.24	111.5	Hump 4 Bds.	0.05"	0.05		0.008			2.75	
.47	111.2		"						2.40	2.71
.50	111.4								2.85	
.52	112.2								2.85	
12.21	112.4	4 Hump 4 Bds	0.10	0.10		0.02			3.10	
.24	112.2								3.5	
.27	111.7								2.9	2.88
.30	111.2								2.6	
.36	112.2								2.3	
.42	112.0								2.9	
.27	112.2	2 Hump 4 Bds	0.20	0.20		0.035			5.1	
.34	112.2								4.5	
.38	112.7								4.0	4.26
.41	112.2								3.6	
.49	111.2								4.1	
.56	112.2	Hump 4 Bds	0.40	0.4		0.07			8.25	
.59	112.7								7.5	
13.06	112.7								7.15	7.43
.07	112.2								7.0	
.09	112.2								6.9	
.12	112.2								7.8	
.17	112.2	115	1.0		8"	—			18.75	
.23	112.2	11"				0.185			18.2	18.4
.27	112.2					0.188			18.5	
.32	109.7					0.125			19.1	
.35	111.2	82	1.50		12"	0.325			25.8	
.39	117.7								26.6	26.13
.44	112.2								26	
.49	110.2	65	2.0		16"	0.353			34.25	
.53	111.2				16"-32	0.355"			35.25	34.72
.57	111.2				16"	0.358			34.4	
14.05	111.2	43	2.5		19"-38"	—			45.1	
.14	110.0								42.5	43.38
.17	111.2								41	
.25	111.2	35	3.0		23"-36"				53.5	
.28	111.2	37			23"				51.9	50.85
.31	109.7								49	
.35	110.2								49	
.42	111.2	27.5	4.0		29"-31"				70.5	
.47	111.2								70.5	70.33
.50	110.7								70	
.57	113.2	22	5.0		33"-30"				84	
17.02	110.4								84.5	
.06	111.2								84.1	84.61
.09	113.0								85.35	
.15	112.0				36"				85.10	

Tuesday 29th March.

Commenced experiment no. 59 for examining the radiation of heat from coils of wire.

Following are dimensions of reel.



External Diam 6.3
Internal Diam 1.25
Diam of iron hub 0.83
Outer length 10.8
Inner length between flanges 9.5

Weight of empty reel 35.55
Volume of Inter flange wire space = 179.6

Wound 8785 cms of double ~~silk~~ cotton covered copper wire 0.040" No 19 B.W.G.
Diam of conductor 0.102 cms.
" " covered wire 0.133 "
in 114 layers of 940 turns in all or 67 turns per layer, the weight of wire (and insulating) material was 695.9 grammes. The resistance of this coil was 1.950 @ 70°F. Its mean external diam was 4.7. The weight of copper was found by stripping about 2 meters to be 88.66% of the weight of covered wire. The space occupied by the wire is ~~[illegible]~~ 153.16

$\frac{4.7 + 1.25}{2} = 2.975$ = diam mean turn

$2.995 \times 3.1416 \times 940 = 8785.5$ cms.

$4.7 - 1.25 = \frac{3.45}{2} = \frac{1.725}{114} = 0.123$

$9.5 \div 67 = 0.1142.$

$153.16 \div 0.133 = 8660$ cms.

Lalande cell

No. 9.30 25	0.276	0.322	0.056	0.828
No. 26.	0.532	0.586	0.034	1.596
" 27	0.540	0.600	0.037	1.620
" 32	0.501	0.587	0.057	1.503
" 37	0.512	1.574	123/2	0.036
" 38	0.598	0.653	0.036	1.794
" 39	0.590	0.658	0.037	1.770
" 40	1.570	2.117	0.348	1.570
" 41	1.746	2.145	0.229	1.746
18.0				
No. 25	0.020	0.060	0.667	0.060
" 26	0.497	0.552	0.037	1.491
" 27	0.499	0.563	0.043	1.497
" 32	0.492	0.570	0.053	1.476
" 37	0.072	2.040	9.110	0.216
" 38	0.588	0.646	0.033	1.764
" 39	0.596	0.666	0.039	1.788
" 40	1.310 varying	2.020	0.542	1.310
" 41	1.534	2.020	0.317	1.534

Cell no 40 Sulphuric acid cell + 30% H_2SO_4
" 41 " " 50% " "
both set to work at 14.0 on 1st.

Ballistic Constant

10 complete vibs in 387.50 T = 38.75

1st semiarc = 432 } $\lambda = \frac{1}{20}\log_e \frac{432}{98} = 0.0741729$
2nd " = 98. }

$1 + \frac{1}{2}\ 1.037087$

10 complete vibs in 389 secs T = 38.90

1st semiarc = 464.25 } $\lambda = \frac{1}{20}\log_e \frac{464.25}{103.25} = 0.0751128$
2nd " = 103.25 }

$1 + \lambda = 1.037557$

Mean T = 38.825

Mean $(1+\lambda)$ = 1.037322

Mean Day Constant = 0.00629 Log = 3.79873

Time	Volts	Phase	G.	Condens	Sieve	Plate	Gauge	Heat	Cleaning	Dist	Phase	Mean	Q
10.25	–								7°	5cm	2.00		
.31											2.50		
.43											1.70	1.90	.0106
.49											1.80		
2.55											1.60		
11.03	112.6	7.5 amp +5°	0.05	0.05	21°		3°	0.008 8.000			1.75		
.09	111.3										2.70		
.16	112.3										2.00	2.05	.0114
.19	111.3						2.15°				1.75		
.24	111.7										2.40		
.32	111.2										2.20		
.38	111.2	8.5 amp +5°	0.10	0.10	38°		12.45°	0.020			2.75		
.45	110.2										2.6		
.50	111.7										2.5	2.78	.0155
.57	111.2										2.65		
12.03	111.7										3.		
12.22	112.2	7.5 amp +7°	0.30	0.20	37°30		12°30	0.045			4.2		
.31	112.2										3.9	4.15	.0232
.41	112.7										4.5		
.46	112.7										4.		
.53	110.2	7.5 amp 40°	0.4	0.40	70°		25°	0.090			7.7		
.58	109.2						26°45	0.088			8.25	7.75	.0433
14.04	109.0										7.8		
.11	111.2						25°	0.090			7.00		
.18	112.2						25°45	0.			8.		
.36	110.2	12.0	1.0	–	–	8°	51°.0	0.215			13.25		
.53	109.7						50°40'				15.5		
.57	110.2										14.9	14.55	.0812
15.03	110.2						51°.				14.2		
.07	110.2										14.9		
.15	110.2	8.4	1.5	–	–	12°30	61°	0.290			22.15		
.23	109.2	8.5				10°30		0.295			22.30		
.46	111.7					12°.		0.300			25.	22.97	.1283
.53	109.7							0.295			20.9		
.58	111.7							0.30			24.0		
16.03	111.2	6.3	2.0	–	–	16°	67°30	0.48			31.5		
.07	112.2						68°.				32.0		
.15	110.2						67°30	0.295			34.25	31.54	.1760
.19	110.2										31.5		
.31	111.2	4.5	2.5	–	–	19°30		0.500			37.5		
.35	113.2										36.		
.38	114.2										36.5	36.33	.2027
.41	111.2	3.7	3.0	–	–	23°		0.650			46.85		
.44	111.2										47.4	47.42	.2646
.48	111.2										48.		
.54	110.2	2.9	4.0	–	–	29°30		0.790			62.4		
.57	110.2										61.5	61.95	.3457
17.01	110.2	2.4	5.0	–	–	33°30		0.96			73.25		
.05	110.2										72.1		
.10	110.2							0.95			71.25	71.86	.4010
.14	110.2										70.85		

Wednesday 28th March

9.0.

No. 26.	0.060	0.078	0.100	0.180	Coil burnt
" 27	0.008	0.108	4.167	0.024	" "
" 32	0.049	0.116	0.101	0.247	" "
" 37	0.000	1.088	—	0	" "
" 38	0.568	0.626	0.034	1.704	" "
" 39	0.566	0.632	0.039	1.698	
" 40	0.00	1.430	—	0	
" 41	0.620	2.040	2.289	0.62	

Repeated transformer test after cleaning all the contacts and making them pressed harder on the periphery of the drum.

16.30. 173 revs: of handle per min
= 1868.4 revs: of commutator " "
= 31.14 " " " sec.

P.D. at mains 110 volts C. 0.175 amps. This 1 amp at 1 ft
" 0.065 " rotating.

In secondary cct. 1 ampere } Energy 1.6 Watts
Res: of " do. 1.6 ω }
Energy rect 110 × 0.065 = 7.15 Watts.
Efficiency 22.2%

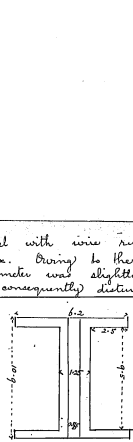
16.35 200 revs: of handle per min
2160 " " contr " "
36 " " " " sec.

P.D. at mains 110 volts C. 0.28 amps. Energy 28 Watts
In secondary cct. 1.4 amps Energy 2.568 Watts
Efficiency 34%

Received 5. 6 light meters 10 bottles 20 electrodes & fittings also 1 hydrometer.

Wound a reel with wire run through melted Carnauba wax. Owing to the solidifying of the wax the diameter was slightly increased, and the winding consequently disturbed.

Weight of reel 36.58 g. before winding.
Diam of wire 0.052 before passing thro. wax. = 0.133



1st layer	64 turns	
2nd	67	
3rd	67	
4th	67	
5th	67	
6th	68.5	
7th	69	
8th	69	
9th	68	
10th	67.5	
11th	68	
	82.0	

Mean 67.5 turns per layer

Length wound on 9010 cms Res: = 1.998 ω
Weight of spool after winding 711 gms Weight added 674.4
Mean diam: of coil 4.85
Mean area of winding 18.24 sq. cms.
Mean bolume ~~88.924 c.c.~~ 163.85 c.c.

$\sqrt{\frac{163.85}{9010}} = 0.135$ $\quad \frac{4.85 - 1.25}{2} = 1.8 \div 14 = 0.129$

$\frac{9.5}{67.5} = 0.141$

Lalande cells

17.30.

No. 38	0.578	0.644	0.038	1.734
" 39	0.580	0.626	0.032	1.740

37, 40 and 101 exhausted and removed.

(83)

Thursday 29th March.

Lalande cells.

8.20	No 38	0.550	0.612	0.038	1.650
	39	0.552	0.616	0.039	1.656

Pendulum Ballistic experiment 28. 3. 88

10 Complete vibs in 395.25 secs $T = 39.525$

1st semiarc $= 459.5$
2nd " $= 101.25$ } $\lambda = \frac{1}{20} \log_e \frac{459.5}{101.25} = .0756273$

$1 + \frac{1}{2} = 1.0378136$

10 Complete vibs in 395.25 secs. $T = 39.525$

1st semiarc $= 478.25$
2nd " $= 106.00$ } $\lambda = \frac{1}{20} \log = \frac{478.25}{106} = .0753347$

$1 + \frac{1}{2} = 1.03766674$

Mean $T = 39.\frac{463}{525}$ } Day Constant $= .006398$
Mean $1 + \frac{1}{2} = 1.03774405$ } $\log = \bar{3}.80599$

Pendulum ballistic experiment 29. 3. 88

10 complete vibs. in 394.25 secs $T = 39.425$

1st semiarc $= 457.25$
2nd " $= 103.50$ } $\lambda = \frac{1}{20} \log_e \frac{457.25}{103.50} = 0.07428$

$1 + \frac{1}{2} = 1.03714$

10 complete vibs in 395 secs $T = 39.5$

1st semiarc $= 447.25$
2nd " $= 101.25$ } $\lambda = \frac{1}{20} \log_e \frac{447.25}{101.25} = 0.07428$

$1 + \frac{1}{2}$ 1.03714

Mean $T = 39.463$ Mean $1 + \frac{1}{2} = 1.03714$

Day const. $= 0.00639$ Log. $= \bar{3}.80574$

17.20.

No 38	0.544	0.610	1.632
39	0.543	0.612	1.629

Time	28th Volts	Mean Ohms	C.	Brightness	Sizeness	Ring.	Bloods	Rings	Bubbles	Nat	Mean	Mean	C
10.42	-	-							7.	6			
.45											7.3		
.51											1.8		
.54											1.65	1.61	.0103
.57											1.50		
11.36	111.7	Thermo 16.0	0.05	3.0	2.0		0.01	3.30			2.7		
.39	111.2										1.5		
.43	111.3										2.35	2.02	0.129
.53	111.0										1.9		
12.00	111.7				20.36			3.45			1.65		
12.25	112.4	Thermo 16.0	0.10	0.10	38°		0.02	7°			2.5		
.31	111.7										2.2		
.39	111.7										3.4	2.51	0.161
.45	111.2										3.0		
.51	112.4										2.45		
14.09	111.2	Thermo 17°	0.20	0.20	57°		0.02	112°			4.2		
14.08	112.2										4.8		
14.11	110.4										4.4		
.18	110.0										4.2	4.35	0278
.24	110.5	Thermo 18°	0.40	0.40	71°30'		0.05	27°			6.5		
.36	112.2			0.40	71°45'			28°30'			5.9		
.45	111.2						0.06				7.75	6.66	.042
.52	109.7										6.50		
15.05	110.2	112	1.0	-	-	7° 8°	0.20	*54°			15.7		
.11	110.7						0.20				16.0		
.20	109.2						0.25				16.25	16.19	.1037
.27	111.2						0.25				16.8		
.43	110.2	114	1.5			12.26	0.30	64°			22		
.49	111.2						0.30	65°30'			23		
.54	111.2					12°16'	0.32	66°10'			22.9	23.6	.1514
16.05	110.7	115	2.0			16°	0.35	69°30'			31.0		
.13	111.2					16°40'					32.5	31.42	.2013
.19	111.2					16°50'					30.75		
.43	110.2	39	2.5			19°34'					39.9		
.48	109.2	38				20°					39.5	39.70	.2544
.56	109.5	37	3.0			23°30'					44.2		
17.07	111.2										43.5	43.80	.2796
.16	111.7	27.5	4.0			28°30'					55.4		
.24	111.2										54	54.72	.3506
.28	109.2										54.75		
.36	110.2	21.5	5.0			35°					71.5	70.75	.453
.38	110.2										70		

Gt. Time	Volt	Ohms	C	Ein Coil	S.C.	Ring	Blind	Swing	Dist	Hour	Mean	A
10.42								7°	7cm	1.2.		
.44										2.1		
.52										1.0		
11.07				-						0.75	1.33	1.33
.31										0.7		
.45	110.7	Tested +60	0.05	0.05	21°10'		0.01			1.15		
.55	110.7									2.85		
12.00	112.3									1.85	1.74	1.74
.06	111.2									1.25		
1.22	110.2	Tested +50	0.10		39°15'					3.75		
.27	112.2				-					2.5		
.36	112.1				-					1.75	2.71	2.71
.40	110.2				-					2.75		
.45	111.2				-					3.3		
2.29	111.7	Tested +60	0.20		39°					3.85		
.36	110.7									2.5	3.78	3.78
.41	110.7									4.0		
.24	111.2	Tested +60	0.40		72°					5.85		
.35	110.2				71°30'					5.5	5.70	5.70
.50	112.2									5.75		
.29	110.7	115	1.0			8°				16.5		
.40	110.65	115				7°55'				16.2		
.40	112.7	-				-				16.5	15.475	15.475
.54	111.2	-				-				14.7		
10.10	111.2	73	1.5			12°				22.5		
.18	111.4	-				11°20				22.15	22.22	1.42
.20	111.2	-				11°40'				22.19		
.27	111.2	51	2			15°30'				33		
.36	111.2					15°45'				31.65	32.22	2.22
.40	111.1					15°45'				32.		
.52	111.2	38	2.5			19°				41.7		
.59	110.2									42.		
16.02	112.2									42.25	41.95	2.95
.11	112.7	34.5	3.0			33°15				48.5		
.18	111.4	-				22°30'				47.5		
.25	111.7	35				23°				51	49.25	3.4
.27	110.7									50		
17.04	111.2	26	4.0			29°30'				65.5		
.08	111.2	-				-				65.7	15.50	4.42
.10	110.7	18.5	5.0			35°15'				80.1		
.13	110.3	-	-			-				81.5	80.75	5.75

Friday 30th March.

Tested large pendulum magnet as follows.
68 turns of wire on left hand limit from yoke
Mean Diam 9.8 = 0.176 m. length reckoned 209.4 cms.
The left hand coil had a res: of 1.63 m mean
" right " " at first = 0.68 m
but on pulling the bottom layer wire this rose to 2.408 m

Wire on 1st layer has a res: of 0.411 m calculated
" " 5th " " 0.480 m
Mean per 0.445 m

5 layers on right hand coil = 2.225
6/7 × 0.176 = 0.150
2.375 m

Total length on 5 layers = 26555 2232
Left hand excess = 2100 .176
28655 = 2.408

5 layers resp. 26555
right hand excess 1800
28355 = 2.382 m
measured = 2.40

2.408 − 1.63 = 0.778 = about 2 layers so that there are probably two layers short circuited

Calomel cells.

9.0	No. 38	0.523	0.532	1.569
	No 39	0.532	0.613	1.596
18.0	38	0.516	0.574	1.548
	39	0.548	0.614	1.554

Pendulum Induction

Time	Volts	Ohms	C	Cabinet	Swing	Ebad	Swing	Eder Dist	Phase	Mean	D.
10.7	-	-					T	73	1·0		
·12									6·75		
·17									1.527		
·22									0·5		
·28	111·5	12.+2	0·05	0·05		0·085			2·0		
·43	111·7								1·5		
·53	111·5								2·0		
·55	111·5	12.+2	0·10	0·10		0·019			3·2		
11·03	110·5					0·022			2·5		
·12	111·2					0·021			2·25		
·17	113·2					0·021			2·75		
·25	110·2	12.+2	0·20	0·20		0·038			3·5		
·32	110·2								5·0		
·39	110·2								4·2		
·50	110·2								2·5		
·59	110·2								4·5		
13·20	110·2	12.+67	0·40	0·40		0·076			7·0		
·30	111·2								7·5		
·37	109·7								7·25		
·50	109·9	103	1·0		8°	0·210			20		
·55	110·0					0·212			18·5		
14·00	110·0					0·212			17·75		
·08	110·3								16		
14·20	110·2	66	1·5		12°	0·307			32·5		
·28	109·7					0·305			31·75		
·36	112·0								33		
·46	108·7	37	2·0		16°	0·419			44		
·53	108·8				16·25	0·415			42		
15·02	109·2					0·416			45		
·10	109·8					0·415			44·5		
·20	109·9	36	2·5		19·25	0·532			55·5		
·28	109·8					0·532			55·25		
·35	109·1					0·533			55		
·46	109·1	33·5	3		22·50	0·610			64		
·55	109·0				22·50	0·625			62		
16·07	108·8				22·50	0·618			65		
·12	109·7				22·50	0·625			63·5		
·30	110·6	22·25	4		29·50	0·860			78·5		
·37	109·5								79		
·45	109·2								78		
·55	109·2	17·25	5		35·15°	1·140			86·75		
17·03	109·4								86		
·10	109·9	17			35·15	1·144			89		
·15	109·8								84		

Ballistic Constant as follows:—

10 Complete vibs: in 335 secs $T = 33.5$ by chronograph

$$\left.\begin{array}{l} 1^{st} \text{ semivibt} = 458.5 \\ 21^{st} \quad - \quad = 138.5 \end{array}\right\} \lambda = \frac{1}{20} \log_e \frac{458.5}{138.5} =$$

10 Complete vibs: in 335.5 secs $T = 33.55$ by Chronograph

$$\left.\begin{array}{l} 1^{st} \text{ semivibt} = 475.5 \\ 21^{st} \quad - \quad = 135.5 \end{array}\right\} \lambda = \frac{1}{20} \log_e \frac{472.5}{135.5} =$$

Mean $T = 33.525$ Mean $\lambda =$

Dampt Const. =

Saturday) 31st March.

Took down pendulum magnet to have it rewound.

Diam. of iron rod 7·8 (Green)

Weight out meter plates as follows.

80 meter couples were cleaned by boiling in KHO and then amalgamated. After 24 hours they were then amalgamated afresh. Shellac varnish was also laid over the copper rods.

The following are the weights observed by means of the delicate pair of scales in the chemical laboratory)

No 1.	23·8014
2	24·542
3	23·7365
4	24·218
5	24·1614
6	24·432
7	24·853
8	24·380
9	24·427
10	24·130
11	24·190
12	24·057
13	23·799
14	24·506
15	24·825
16	24·059
17	24·018
18	23·230
19	24·359
20	24·061

The head of the lower presses against the lower number of each pair of plates.
i.e. nos. 1, 3, 5, 7 etc.

(31.3.97)

Calculated from diagrams the activity of the Brown engine as follows.

Diam of cylinder 11" = 95·03 sq. in.
" rod 1⅞" = 2·76 sq in

Length of stroke = 30"

For Front $\frac{(95.03 - 2.76) \times 2.5}{33000}$ = .00069 = Front Coeff.

Back $\frac{95.03 \times 2.5}{33000}$ = .00719 = Back Coeff.

Speed 79 revs. per min. {Boiler pressure in last couple 105 / in first 3 couples 100}

At 9.10	The mean diag. press. of	Front = 20·05 (in sq. in)	H.P. 11·07	HP	Kilo
" 9.10	" " " "	Back = 15·27	8·73	19·77	14·74
" 9.12	" " " "	Front = 19·2	10·6		
" 9.15	" " " "	Back = 17·93	10·13	20·73	15·46
" 9.20	" " " "	Front = 15·08	8·32		
" 9.15	" " " "	Back = 16·0	9·09	17·41	12·99
" 10.00	" " " "	Front = 11·21	7·42		
" 10.00	" " " "	Back = 13·24	7·32	15·36	11·45

H observations were commenced and the mean time of one complete vibration was 11·5 secs. with the magnet unweighted

Lalande cells 16·20.			
No 38	0·352	0·496	1·056
" 39	0·338	0·500	1·014

87

Monday 2nd April

Winding of magnet as follows.
Iron core 7.7 diam. mean
With tapping 7.8

On left hand coil		On right hand coil	
1st layer	199 turns	1st layer	196
2nd	198	2nd	197
3rd	197	3rd	196
4th	197	4th	195
5th	57	5th	197
		6th	76
Total	848		1057

Grand total 1905 turns

Mean Diam on 1st layer 9.57 — 9.55
" " 5 " 9.89 — 9.86

Took following observations for determining H
Magnet 11.4 cm long 1.12 broad and 0.284 thick
swinging in box.
260 complete vibs in 2980.8 secs observed by aid of chronograph. 1 vib in 11.4465 sec.
Brass ring added to magnet
Weight of Ring 167.278 gr.
Inner Diam 4 cms
Outer " 6 "
Depth 1.283
Moment of inertia 1087.34 cnigms.
This loaded 120 complete vibs in 2989.1 secs.
or 1 vib in 24.908 secs.
temp 22° C.

The turning off of the dynamo current at 9.00 appeared to affect the instrument very slightly

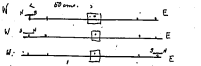
From these data the value of H = 0.293
M = 513.
m = 45.
Magnetic $\frac{M}{m}$ = 14.7
Lunn for 29.0 = 0.4.10 - 1900.

Torsion observed as follows
Scale distant 307.5 cms from magnet and each div = 2 cms.

90° torsion counter clockwise + 0.08 gcs
Mean of six swings = + 4.403 = 4.323
90° torsion clockwise − 7.423 = 7.516
Mean of six swings + 0.087 gcs
} = 5.92 scd. = 11.84 cms.

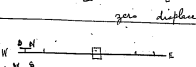
~~Tors~~ torsion
zero mean of six swings =

Deflection experiment with small magnet in box hung in oil below. Scale dist. 311 cms



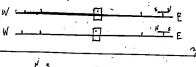
12.3 divs +
12.4 − ~~+~~
12.4 − +
12.7 − −
} 12.45

zero displaced 2.5 on red side −



12.31 ~~+~~ −
12.31 +
12.58 −
12.43 +
} 12.41

zero displaced 1.0 on red − side



29.8
30.45
30.59
30.00
} 30.21

Mean of 1st 2 set 12.43
" 3rd 30.21

Tuesday 3rd April.
Rewired building with 9 P. R. wire

Wednesday 4th April.

Set Meters to work at 13 o'clock. Took off at 17. average at about 113.5 Volts

Particulars of spools as follows.

Spool No.	Dimensions: Outer Diam	Inner Diam	Side Diam	Side Weight	Side Thick	Wire Weight	Wire Diam	Weight: Total Weight	Gross	Net	Wire: Gross	Net	Wire Dimension: Diam Bare	Diam Insul	Resistance Ohms	Wt. Per Yd.	Substance with which wire coated	No. of layers wound
1	6·3	1·25	0·85	1·5	0·06	35·55	711·0	70·88	0·102	2·0414	0·133	0·0714	0·0158		—	14
2	6·2	1·25	0·85	1·5	0·55	36·58	711·0	70·45	0·099		0·128	0·0685	0·0158		Gunmetal Wire	14
3	6·2	1·25	0·90	1·5	0·6	34·36	690·0	65·26	0·095	0·0911	0·118	0·0664	0·0158		Shellac in Alc.	14
4	6·25	1·25	0·822	1·5	0·54	33·77	669·0	61·63	0·1083	0·1031		0·0672	0·0158		Tinfoil asphalt	14
5	6·2	1·25	0·95	1·5	0·37	33·67	605·5	61·41	0·0909	0·0861		0·0577	0·0158		Asphalt 1/2 lb.	14
6	6·25	1·25	0·90	1·5	0·55	34·73	662·2	63·41	0·0911	0·0859		0·0619	0·0158		Gutta-percha	14
7	6·05	1·30	0·90	1·5	0·5	37·24	777·0	73·93	0·1011	0·0879		0·0713	0·0159		Shellac Varnish & Plain.	14
8	6·10	1·25	0·90	1·5	0·46	32·43	707·3	67·13	0·0916	0·0778		0·0615	0·0159			14

Test Time	Mean Current in Amps	Length of Circuit in ft. "Ohm"	Mean Drop of Volts	Drop of Volts per Amp	Drop of Volts per Ohm	Drop of Volts per Mile	Length of Wire in Miles	No. of Circuit Km.	Rate of cost	Drop of Volts per Ohm
9·40	67	8685	4·7	153·4	8660	2·975	9·2616	8785	1·0725	140·05
9·45	67·7	9012	4·88	167·5	9245	3·07	9·6416	9145	1·0969	137·2
9·50	67·20	8846	4·53	163·3	8738	2·81	9·0967	8773	1·0710	134·7
9·55	66·97	7850	4·26	138·7	8663	2·84	8·9213	8778	1·0709	132·5
9·20	65·72	8379	4·56	167·2	8317	2·92	9·1713	8440	1·577	140·1
8·55	62·79	8025	4·74	158·8	8252	2·99	9·3932	8256	1·008	142·2
8·56	62·05	9238	5·02	175·4	9436	3·16	9·9237	9590	2·038	149·9
8·56	62·25	8726	4·60	145·4	8769	2·93	9·2416	8799	1·573	136·6

Res. of spool platinoid wire about 40·2 ω, the current flowing this being say $\frac{113.5}{40.2}$ = 2·8234 amps during 300 mins = 180000 sec = 508200 coulombs.

89) Thursday 5th April

Motor run from 10 to Noon and from 13h 17.5 = 6h 5m = 365m = 21,900 r. av. C. = 2.82 = 61.750 C

Tried Pendulum induction experiment with 2 amperes through the Magnet to ascertain if the induction was in any way altered with the facing of the poles by plates of different materials.

Res: of Pendulum connections 5w including leads to Galv. table.

Res: of magnet coils 2.4 w each. approx.

Res: of connections in Pendulum apparatus 1.1 w

Pendulum Ballistic Constant.

10 Complete vibs in 335.25 T = 33.525

1st semiarc = 4844.5 } λ = 1/20 log_e 4844.5/131 =
21st " = 131 }

10 Complete vibs in 336.75 T = 33.675

1st semiarc = 442.75 } λ = 1/20 log_e 442.75/119.25 =
21st " = 119.25 }

Measured off 9 Platinoid res: of about 11w each and 46 . . . . 5.5w

The 11w lengths were 14 metres

" 5w " " about 7 "

Spool wound with wire drawn through glycerine.

Time	Volts	Ohms	2 amperes Tan G.	Swing	Dist	Throw		
13.11		5.3.	15°.45'	7°	1.5	110		
.16						109		
.18			15°.40'			108		
.24						108		
.39						107		
.44		5.1	16°			114		
.49						111.5		
.53						114.25		
.59			17°			111.3	113.5	
14.04		5.3	16°			109.25		
.07						110.8		
			Wire broke and replaced					
.34	111.2	5.3	15°.25	Brass plate		110.		
.43	"		16°.			105		
.52	109.2					107	107.5	
.58	112.2					107		
15.03	111.2					109		
.08	112.2					107		
.14	111.7		16°	Brass plate		109.1		
.20	112.2					105.		
.29	110.7					109	107.84	
.33	111.7					109.25		
.51	109.7		16°.45'	Brass plate		107.9		
.57	111.2	5.5w	16°			107		
16.06	111.2					107	107.03	
.09	110.2					106.2		
.14	111.7	5.5w	16°.15'	Brass plate		108		
.18	111.2	5.8w	16°			108	107.0	
.22	111.2					105		
.49	112.2	5.7w	16°.			105		

Temperature experiment with coils of wire connected in series. 4th Apr. 88.

Time	Res. in ect.	approx. Q.	Time from start	1 Water	2 Kerosene	3 Shellac	4 asphalt	5 asphalt 10.50 C	6 Gum-lac 15.5 Ohms	7 Paraffin Wax	8 Phen.
15·00	40	2·4	0	68°	68°	68°	68°	68°	68·5	68·5	68°
·30			30	132	126	132	136	133	130	137	133·5
16·0			60	163·5	156·5	167	169	167·5	163	172	167·5
·30			90	178	167·5	178·5	180	176·5	175	188	180·5
17·0			120	184·5	170	180	184·5	178·5	177·5	196	188·5
·30			150	190	173	184	186	179	178·5	202	203
18·0			180	192	174	184·5	186	178	178·5	206	196

Burnt at 17.17

Temp. experiment with same coils of wire and another (no 9) wound with wire drawn thro. glycerine

Time	Res. in ect.	Q.	Time from start	1	2	3	4	5	6	7	8.	9 Glycerine
15·30	33	3·3	0	66	66	66	66	66	65	67	66	66
·40			10	193·5	193	194	194	195	152	196	193	130
·50			20	174	167	186	194	177	174	190	196	166
16·00			30	218	196	228	228	218	216	234	228	200
·10			40	229	225	235	235	232	232	252	270	232
·20			50	298	257	301	298	278	282	312	313	258
·30			60	336	285	339	331	304	307	354	353	290
·40			70	323	271	316	305	282	286	340	330	262
·50			80	292	246	282	274	256	258	312	299	240
17·00			90	270	231	257	253	237	238	290	278	225
·10			100	250	216	232	234	219	220	269	264	210
·15			105	224	194	200	206	194	197	232	226	189
·20			110	206	182	184	190	180	182	194	209	176

Calculated some of the Magnetic Induction results as follows.

Let n = the no. of lines of force cut per sec. by the wire.

Then $E = n$.

$\therefore C = \frac{n}{R}$ where R = approx. 5280 ω. (galvo + coils)

$a = \frac{N}{R}$ where N = total no. of lines cut.

$\therefore N = aR$.

a is calculated in microcoulombs.

$= a \times 10^{-7} \times R \times 10^{7} = 100\, aR$.

$= 528000\, a$

The exciting power $= \frac{4\pi}{10} nc$ where n = number of ~~actual~~ turns (probably) in March 1520 $= 1910\, c$ where c is magn. c. in amperes

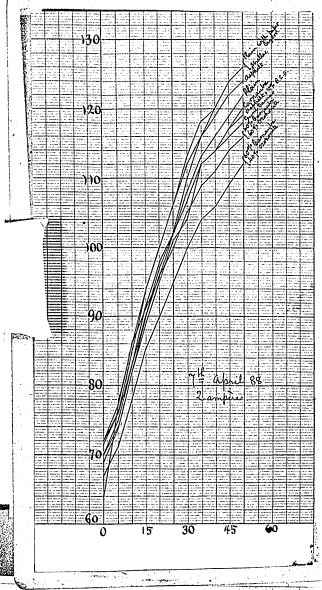
$f(d) + x = \frac{1910\, c}{528000\, a} = \frac{1.910 \times 10^{3}}{5.28 \times 10^{5}} = 3.617 \frac{c}{a} \times 10^{-3}$

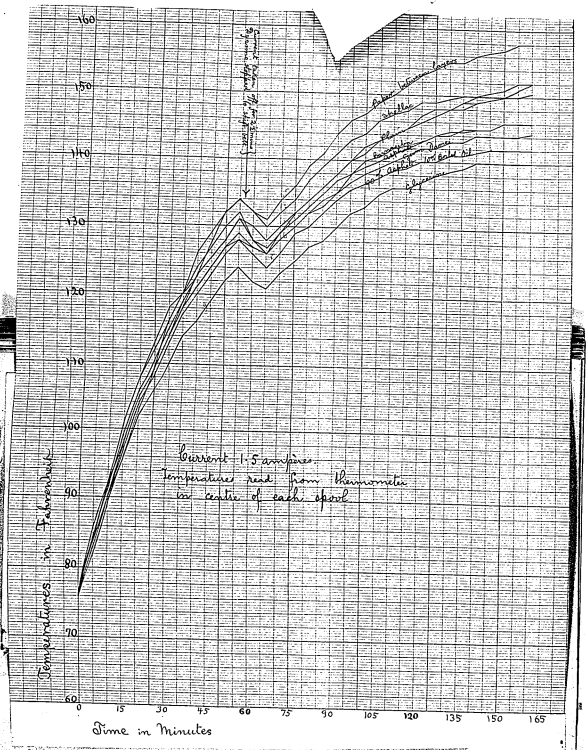
where x = res. of wire and $f(d)$ res. of distance d air

$f(d) + x$ has been worked out for a few of the March results as follows.

S.P. Dist.	$\frac{c}{a}$	$f(d)+x$	$\frac{c}{a}$	$f(d)+x$	Mean	Calcd. from $\frac{1}{\sqrt{1+\frac{d^2}{0.0002}}}$	Taking $f(d)=d^2$ and $d=1$
0·5	$\frac{2.06}{2.5}$	0·015	$\frac{4}{2.855}$	0·017	0·016	0·013	0·0127
0·8	$\frac{2.75}{2.84}$	0·018	$\frac{5}{2.85}$	0·021	0·0195	0·0165	
1·0	$\frac{2.95}{2.82}$	0·020	$\frac{5}{3}$	0·0224	0·029	0·018	
1·5	$\frac{2.75}{2.42}$	0·024	$\frac{5}{3.7}$	0·0257	0·025	0·022	
2·0	$\frac{3.24}{2.4}$	0·028	$\frac{5}{4.3}$	0·0300	0·029	0·026	
3·5	$\frac{3.1}{2.16}$	0·031	$\frac{5}{6.23}$	0·0284	0·0325	0·0295	
4·0	$\frac{2.66}{2.25}$	0·039	$\frac{5}{7.41}$	0·0339	0·038	0·035	0·036
5·0	$\frac{2.18}{2.28}$	0·040	$\frac{5}{8.6}$	0·0415	0·0425	0·0395	

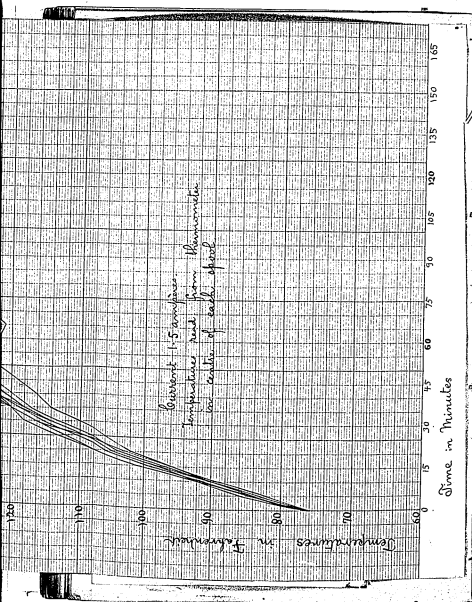
The highest ~~ply~~ reached was 1·0 microcoulomb or max. Intensity $= 528000$ and the square surface being 53·3 or nearly 16,000 line per sq. cm.


130
120
110
100
90
80
70
60
0
15
30
45
60
7 12 April 88
2 ampères



Meter numbers
= 6·25 hours =
= $\frac{110}{40}$ = 2·75 c

a big
each
the
the
further
being



Friday 6th April

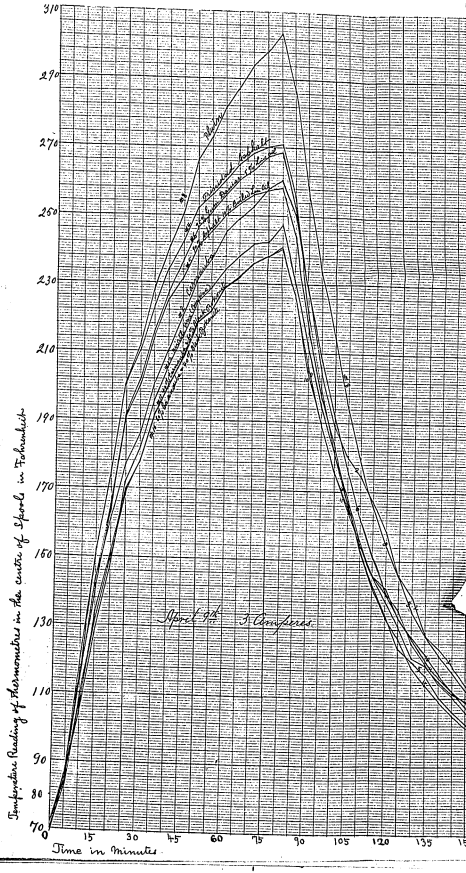
Meter running on 40w res: from 10.0 to 17.15.
= 6·25 hours = 375 m. = 22500 secs. the mean current
= $\frac{110}{40}$ = 2·75 amp. = 61,875 Coulombs.

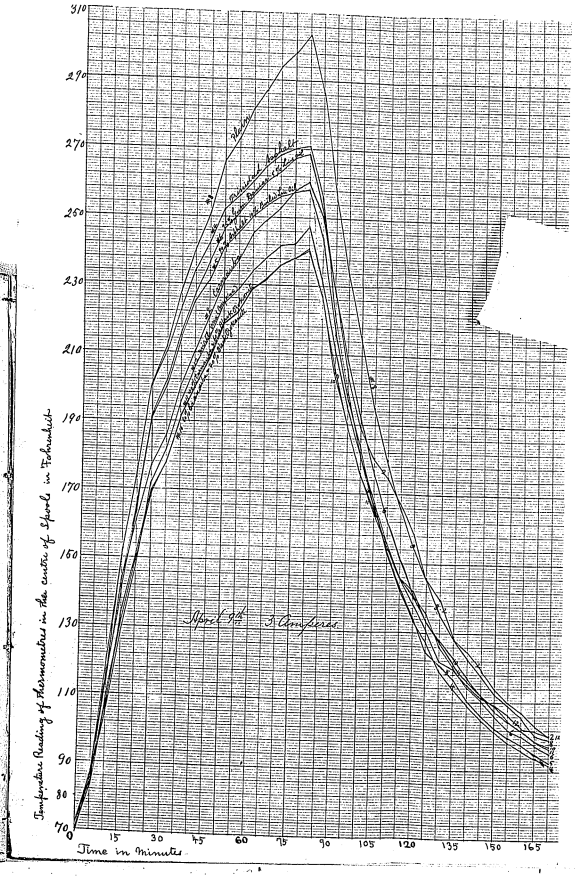
Saturday 7th April

A long series of readings was obtained with the pendulum magnet with facing of various materials on its poles. Zinc in Lead. Fibre. India Rubber and hard rubber were tried without any decided difference being observable in the induction results.

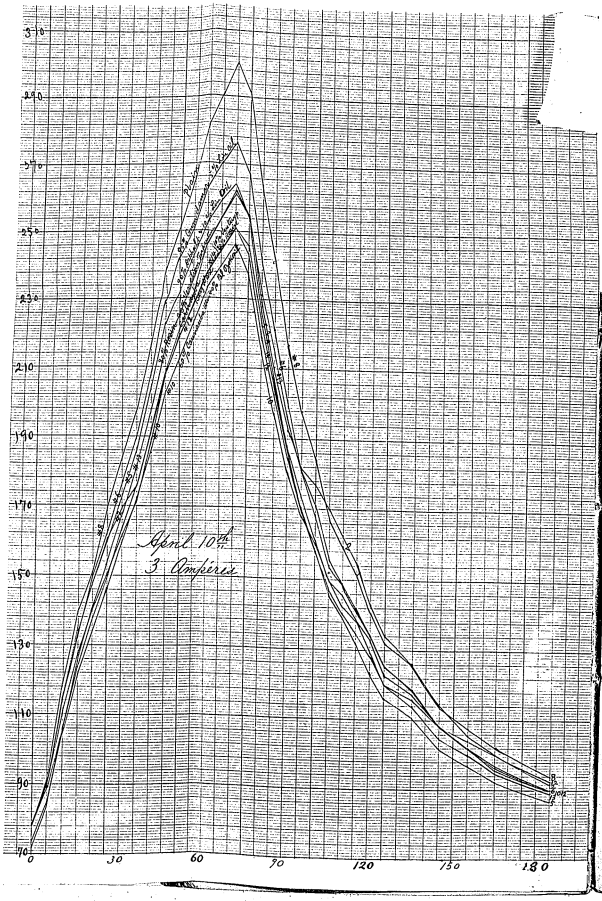
Date	Time on	Time off	Seconds	Max in Alt	Mean Alt	Mean L.	Coulombs.
4. 4. 88	13.0	17.0	14400	40.2	113.5	2.823	50,820
5. 4. 88	10.0	17.5	21,900	40.2		2.82	61,760
6. 4. 88	10.0	17.15	22,500	40	110	2.75	61,870
7. 4. 88	10.10	16.25	19,500	40	110	2.75	53,630
8. 4. 88	10.40	17.40	21,600	40	112	2.80	60,480.
9. 4. 88	8.0	18.00	32,400	40	112	2.80	90,720
10. 4. 88	11.00	17.00	18,000	40	112	2.80	50,400

Record of Experiment Numbers




Temperature Reading of Thermometers in the centre of Spool, in Fahrenheit
310
290
270
250
230
210
190
170
150
130
110
90
80
70
0
15
30
45
60
75
90
105
120
135
150
165
Time in Minutes
Spool No. 1 Compressed

ent Numbers


April 10th
3 Ampères
0
30
60
90
120
150
180
110
130
150
170
190
210
230
250
270
290
310

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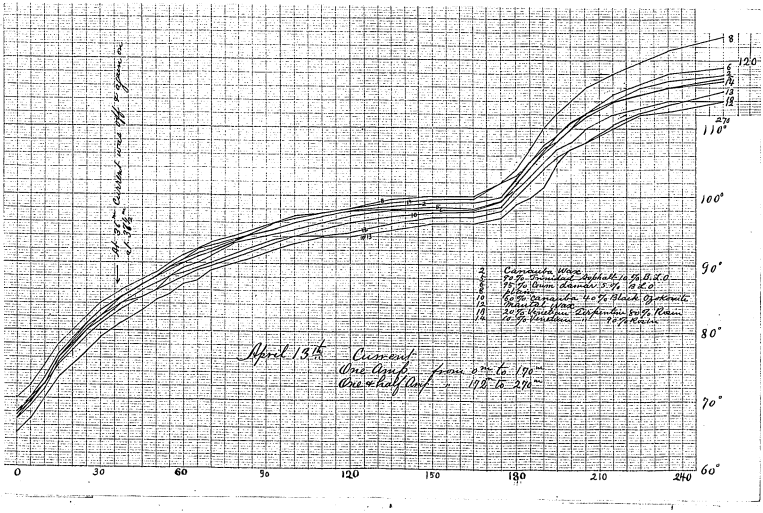

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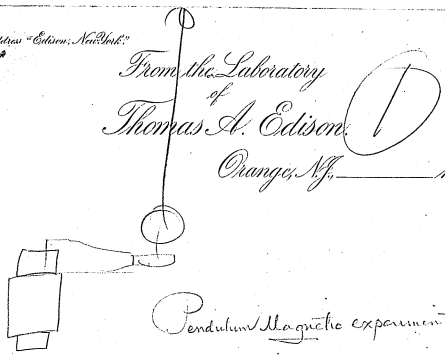

Pendulum Magnetic experiments.

1st See that the Yoke is dead flat & makes almost perfect contact, & so bright & clean & tighten the bolts. Be sure the moveable pole pieces are bright & dead flat in the various positions there are to be moved. In moving pole pieces see that both are moved equally by using a scale or gauge. So that the working edge of both pole pieces are in every experiment equidistant from the inner edges of their respective Coils. See that the ~~edge~~ surfaces of the pole pieces facing each other from which the lines of force go out are polished clean.

Put on a current the amperes of which are perfectly regulateable. ~~[illegible]~~ The magnet should be sharply rapped with a small hammer about dozen times ~~[illegible]~~ before each reading so as to set the molecules. The maximum magnetism for a given current is only obtained when the magnet is well rapped. The effect is to increase the amount of magnetism _____

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A Thermometer should be secured on the iron to get its temperature
The exact vibrating time of the pendulum must be determined - and the average velocity in feet per second of the cutting wire
I want to obtain curves, of Emf starting with pole pieces widely separated as possible up to the Edge of the Core - and varying by millimeters up to a space that will just allow the wire to pass between the poles, when you come to space between the poles of ⅜ inch vary by ½ millimeters -
Supposing the poles to be set at widest space put on a fraction of an ampere, hammer the magnet & let go the pendulum get reading - do this 2 or 3 times, Then increase the ampere to a greater fraction, & so on until the magnet is practically saturated & any further current does not appreciably increase the Emf -
I should say a curve with 20 points would give a good line - Having done this - set the pole pieces towards each other so the space

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is diminished by one millimeter, —
go through exactly the same readings —
Do as until the pales are so close as to
just let the wire pass —

After these are all plotted in Curves
accurately we will then be enabled to
determine the effect of any change or
supposed magnetic polarization. —

I will have made up some varnishes.
1 Shellac, 1 Copal, - white paint, + others
The surface of the pales are to be varnished
thinly with each & dried + several readings
taken ~~[illegible]~~ with pales about
3/8 apart — In addition to varnishes, I want
to plate the Ends of the pale pieces with

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1st Copper polish the same as read — then if no change plate silver over this if no change plate gold, then tin, then Lead then Zinc, & other metals, If no effects are noticed they can be removed down to the iron — Then we will improve sheets of various material poured on the pales a little edge of some non magnet material Gang pull round the edge to hold the material 1/16 thickness of following parafine, Sulphur, Asphalt, Gutta percha, Glass, Vulcanite, Nitrate potash, Boracic acid, Glacial phosphoric acid, Caustic Soda, Chloride Zinc, Chloride Silver, Chloride Lead, Carnauba Wax — Lithange, Lead, antimony, Bismuth fusible metal, Tin, Sulphide Lead, Phosphide Lead, Sulphide Arsenic, Sulphide, Aluminum Mercury Lead amalgam — ~~Chloride~~ Arsenic Trifluoride antimony - Chloride Aluminum

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Trichloride Bismuth
Cupric Chloride.
Mercuric Chloride,
Manganous Chloride
Stannous Chloride
Aluminum Bromide.
Trioxide Chromium
Tri Sulphide Antimony
Chlorate Silver
Chlorate Potash.
Ferrous Sulphate.
Sulphate Magnesium.
Sulphate Zinc
Calcium Borate
Borate Sodium
Nitrate Calcium.
Nitre

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Phosphate Soda - and others we may think of After these clean out & amalgamate it with Mercury by means of Sodium amalgam - of no change We will make a glass cell twice the area of the End of the face of pole piece, use 1/16 inch glass 1/8 @ 3/16 space between the glasses & put together Except at top by say Marine glue or gutta percha & strips of Vulcanite This cell can be used for certain liquids, another cell should be made & put together with say lead & a cement not affected by Hydrocarbons - - The cells are put between the poles the interrupt the lines of force or not as the case use in cells, strongest Sulphuric acid. HCl Nitric Acid, glycerine, glacial Acetic acid Saturated Solution of Salt, ditto Chl Calcium ditto, Iodide K - do, Sulphate Iron - Bromic acid. Chloride Sulphur; Oleic acid, Cond Solution alum - do Chloride Ammonia,

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Borax, Sugar, glucose, Tar (wood) —
Balsam Copaiba, Aniline Oil, Vaseline,
Petroleum Wax — Succinic acid,
Bisulphide Carbon do saturated with
Sulphur — Benzol, Oil Myrbane,
Conc Solution Aniline Violet in alcohol,
full of Lampblack — Iodine dissolved in
Bisulphide Carbon saturated,

Note use sheets of Rock salt Mica, Vulcanized fibre,
Slate, brass Tin Lead Zinc, etc. — place cell —

Cell Liquids continued Chloroform, Alcohol,
Oil Cade, Linseed oil Saturated Solution
Sulphate Copper — acetate Lead,
Sulphuric Ether, powdered graphite (P)
Electrolypes plumbago _____ Mercury —

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Will add to these lists during experiments, I want also to keep magnets at regular temperature & pass up just at the moment of the passage of the wire a strong blast of air heated to about ~~[illegible]~~ 1000 Fahr.

~~[illegible]~~,

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Kennelly —

Additional Experiments on Pendulum

To determine if Magnetic stress is greater or less through different Diamagnetic Material than air —

Set the poles about $1\frac{1}{2}$ @ 2 inches apart ~~leaving a space~~ put plates of ~~#~~ Cells of various substances on both ends leaving say $\frac{1}{8}$ or $\frac{1}{4}$ inch between them for air to pass. Reading alternately with & without plates will show any difference

Use plates of Gutta Percha Hard Rubber Wood, The Metals, Carbon, Glass, Asphalt Pitch, Porcelain, Melted Boric Acid — Melted Nitrate Potash

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Metal Cyanide Palladium
glacial phosphoric acid fused
into plate & immediately varnished
Litharge, plaster Paris, Mica
Soft Rubber, Paraffine, Napthalin
fused — Anthracene fused,
Camphor fused — Stearine,
Spermaceti, Microcosmic Salt,
Chloride Calcium, fused alum
plumbago common pressed,
Soap — Oxychloride of Zinc,
Chl. Zinc fused & varnished quickly
Sulphide Lead, Sulphide Copper
Sulphide Arsenic do Copper do
Bismuth, Sulphur, gum Dammar

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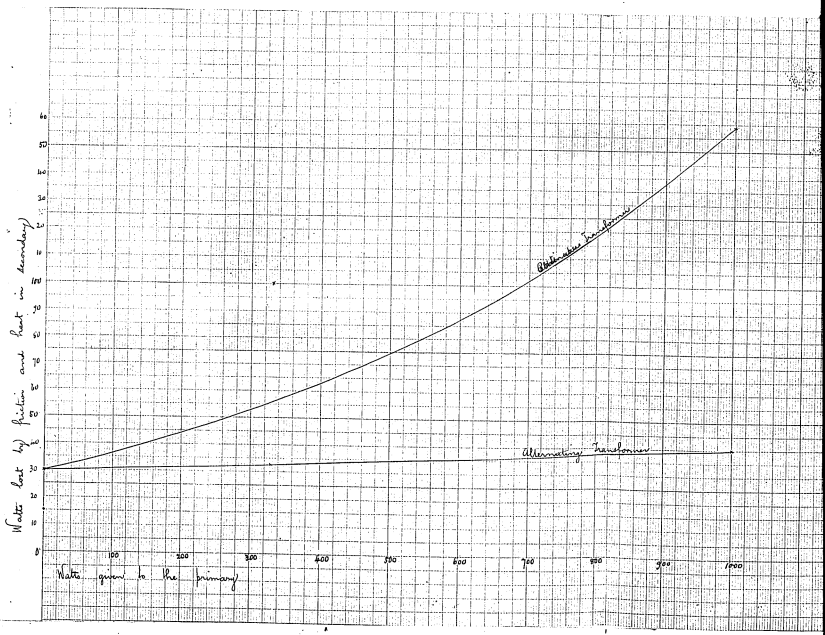
I sum Dextrin etc in the Cells use Varian's liquids - These Experiments are to replace the other Experiments with plates & cell with magnet poles close together of thought preferable, The question is whether we use concentrical field & a thin cell or widely separated poles + Double thick cells or plates,

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